

STRATIGRAPHY OF THE COTTON VALLEY  
BEDS OF THE NORTHERN GULF COASTAL  
PLAIN

by

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## INTRODUCTION

The Upper Jurassic Cotton Valley sediments comprise a thick, entirely subsurface, sequence found in deep wells in northeastern Texas, southern Arkansas, northern Louisiana, central Mississippi, and western Alabama. The geographic distribution of the approximately 160 wells which have so far penetrated the Cotton Valley is as follows: southern Arkansas 106, northern Louisiana 35, northeastern Texas 15, central Mississippi 3, western Alabama 1. The Upper Jurassic rocks of southern Arkansas and northern Louisiana have produced large amounts of petroleum and wildcat drilling to these rocks continues to be active. During the past few years, drilling has been extended to outlying areas of northeastern Texas, Mississippi, and Alabama.

The pre-Upper Cretaceous stratigraphy of the area, which is summarized in Table I, has been discussed by W. B. Weeks<sup>1</sup>, R. T. Hazzard<sup>2</sup>, and R. W. Imley.<sup>3</sup> Other early descriptions of these rocks are to be found in papers by H. K. Shearer<sup>4</sup> and by Grage and Warren.<sup>5</sup> These works provide a background for the present paper, the purpose of which is to present details of Cotton Valley stratigraphy based on a study of well cuttings, cores, and electrical logs.

- 1- Weeks, W. B.; South Arkansas stratigraphy with emphasis on the older Coastal Plains beds; Bull. Amer. Assoc. Pet. Geol., vol. 22, no. 8, August, 1938, pp. 953-983.
- 2- Hazzard, R. T.; Notes on the Comanche and pre-Comanche ? Mesozoic formations of the Ark-La-Tex, and a suggested correlation with northern Mexico; Shreveport Geological Society Guidebook, Fourteenth Annual Field Trip, 1939, pp. 155-179.
- 3- Imley, R. W.; Lower Cretaceous and Jurassic formations of southern Arkansas, and their oil and gas possibilities; Arkansas Geological Survey Information Circular 12, Little Rock, 1940.
- 4- Shearer, H. K.; Developments in South Arkansas and North Louisiana in 1937; Bull. Amer. Assoc. Pet. Geol., vol. 22, no. 6, June, 1938, p. 724.
- 5- Grage, V. P. and Warren, E. F. Jr.; Lisbon oil field, Claiborne and Lincoln Parishes, Louisiana; *ibid.* vol. 23, no. 3, 1939.

SYSTEM	EUROPEAN EQUIVALENT	GROUP	FORMATION	L I T H O L O G Y	MAXIMUM THICKNESS IN FEET	REMARKS
CRETACEOUS (Comanchean Series)	Upper Albian	Washita	Undifferentiated	Shale, limestone, marl.	100+	
	Middle Albian	Fredericksburg	Kiamichi Goodland Walnut	Shale and some limestone Limestone Shale	400+	
	Lower Albian	Trinity	Paluxy	Red and gray shale, sandstone, limestone	1200+	Produces oil and gas-distillate in eastern Texas, northern Louisiana, southern Arkansas.
			Glen Rose Sub-Group Mooringsport Ferry Lake Rodessa Pine Island Sligo	Gray and red shale, limestone and sandstone Thick-bedded anhydrite and thin layers of limestone and shale.	750+	Produces oil, gas and distillate in Arkansas, Louisiana, and Texas.  Produces oil and gas in Arkansas, Louisiana, and Texas.
				Partly oolitic limestone, gray and red shale	500+ 500+	
				Gray and red shale, thin limestones. Partly oolitic limestone, gray and red shale.	500+ 300+	
	Aptian					
	Neocomian	Coshuilla	Hosston	Red-green shale, sandstone	2300+	Produces oil and gas in Arkansas, Louisiana, and Texas.
JURASSIC (Upper)	Tithonian	Cotton <sup>a</sup> Valley	Schuler <sup>a</sup>	Pastel varicolored shale, gray shale, limestone, white sandstone (Dorchester member) <sup>b</sup> . Red-green shale, gray sh., limestone, red and white sandstone (Shorgalco member) <sup>b</sup> .	2300+	Produces oil and gas-distillate in Arkansas, and Louisiana.
	Portlandian					
	— ? —					
	Kimmeridgian		Bossier <sup>b</sup>	Gray and red shale, sandstone and limestone	1900+	Produces oil in Arkansas (Schuler Field)
			Buckner	Red and gray shale, anhydrite, dolomitic limestone, oolitic limestone.	500+	
	Oxfordian		Smackover	Oolitic limestone, dense limestone, dolomitic limestone, minor shale and sandstone.	1200+	Produces oil and gas-distillate in Arkansas and Louisiana
			Eagle Mills	Red shale, sandstone, and salt	1250+	
PENNSYLVANIAN ?			Morehouse	Gray and red shale, sandstone, and limestone.	1190+	See Imley & Williams, Bull. A.A.P.G., Vol. 26, No. 10, 1942, pp. 1672-73.

a- Modified usage in this paper.

b- New Name in this paper.

Acknowledgements: Many of the sample records of early wells used in this study were prepared by W. B. Weeks and C. W. Alexander of the Phillips Petroleum Company, and in addition these men provided much helpful information as the work progressed. Dr. R. W. Inlay of the U. S. Geological Survey contributed important paleontological information, made valuable suggestions, and read the manuscript critically. Dr. R. C. Moore, of the University of Kansas, outlined the work, directed its course of procedure and made other helpful suggestions. Dr. P. D. Krynine, of the Pennsylvania State College, aided in petrographic examinations. The writer is deeply grateful to these and to the following geologists for their aid and encouragement: C. I. Alexander, Jules Braunstein, E. M. Cox, W. M. Furnish, R. T. Hazzard, C. J. Hoke, J. H. McGuirt, T. H. Philpott, Joseph Purzer, Van D. Robinson, and R. B. Totten.

Appreciation is expressed to C. O. Stark and D. E. Lounsbery, of the Phillips Petroleum Company, for permission to use the well information embodied in the study.

## DETAILED STRATIGRAPHY

### COTTON VALLEY GROUP

The name "Cotton Valley formation", first used by H. K. Shearer,<sup>6</sup> was formally proposed and defined as a new stratigraphic name by R. T. Hazzard for the Shreveport Geological Society.<sup>7</sup> The type locality was designated as the Cotton Valley Field in Webster Parish, Louisiana,<sup>8</sup> and the original definition was "the marine, fossiliferous, dark shales, limestones, and sandstones lying immediately below the Hosston "red beds." It was recognized that to the north, updip, the marine rocks passed into "red beds" of essentially non-marine character, which were named the Schuler facies, from the Schuler Field in Union County, Arkansas. The present writer will demonstrate herein that the Cotton Valley beds comprise two units of formational rank, and proposes that Cotton Valley be raised to the rank of a group that will include these two formations.

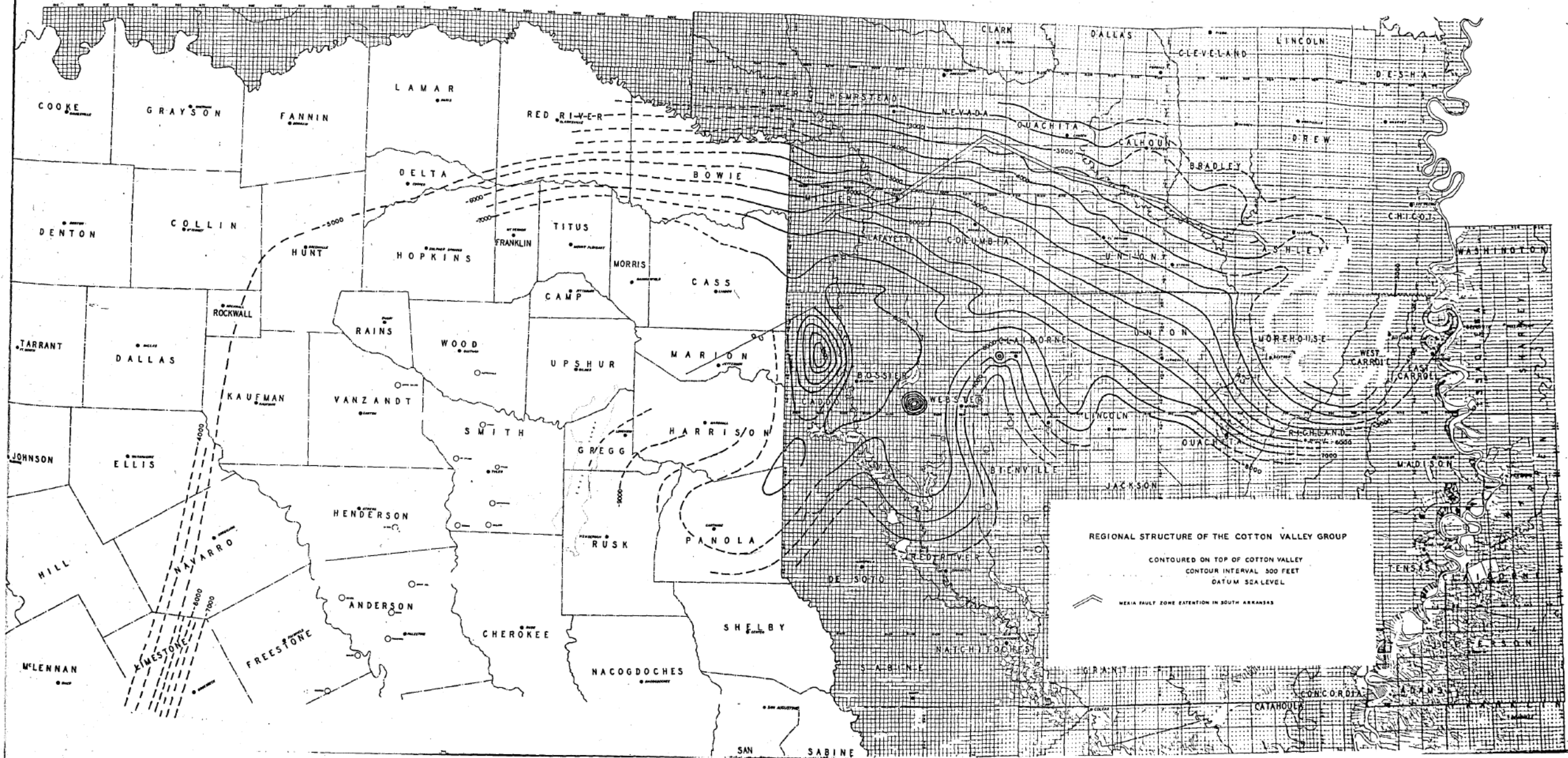
The Cotton Valley Group, then, includes the rocks lying stratigraphically between the base of the Hosston formation (Travis Peak of East Texas petroleum geologists) and the top of the Buckner formation, or the top of the Smackover formation in areas where the Buckner is not recognizable. It consists of the Schuler formation above and the Bossier Formation below.

The deep-lying structural features of the area are shown by contours drawn on the top of the Cotton Valley Group (plate I). These include (1) the East Texas Basin of northeastern Texas, (2) the Sabine Uplift of northwestern Louisiana and adjacent portions of East Texas, (3) the monoclinial area of south-central Arkansas and north-central Louis-

6- Shearer, H. K.; op.cit., p. 724.

7- Hazzard, R. T.; ibid., p. 156.

8- No well in the Cotton Valley Field has completely penetrated the Cotton Valley beds. The deepest well in the field (stratigraphically) is the Hunt #8 Babb which was bottomed in the upper part of the Shongaloo member of the Schuler formation (plate IV)



iana, which is bounded on the north by (4) a system of graben-type faulting, and (5) the Monroe Platform of northeastern Louisiana.

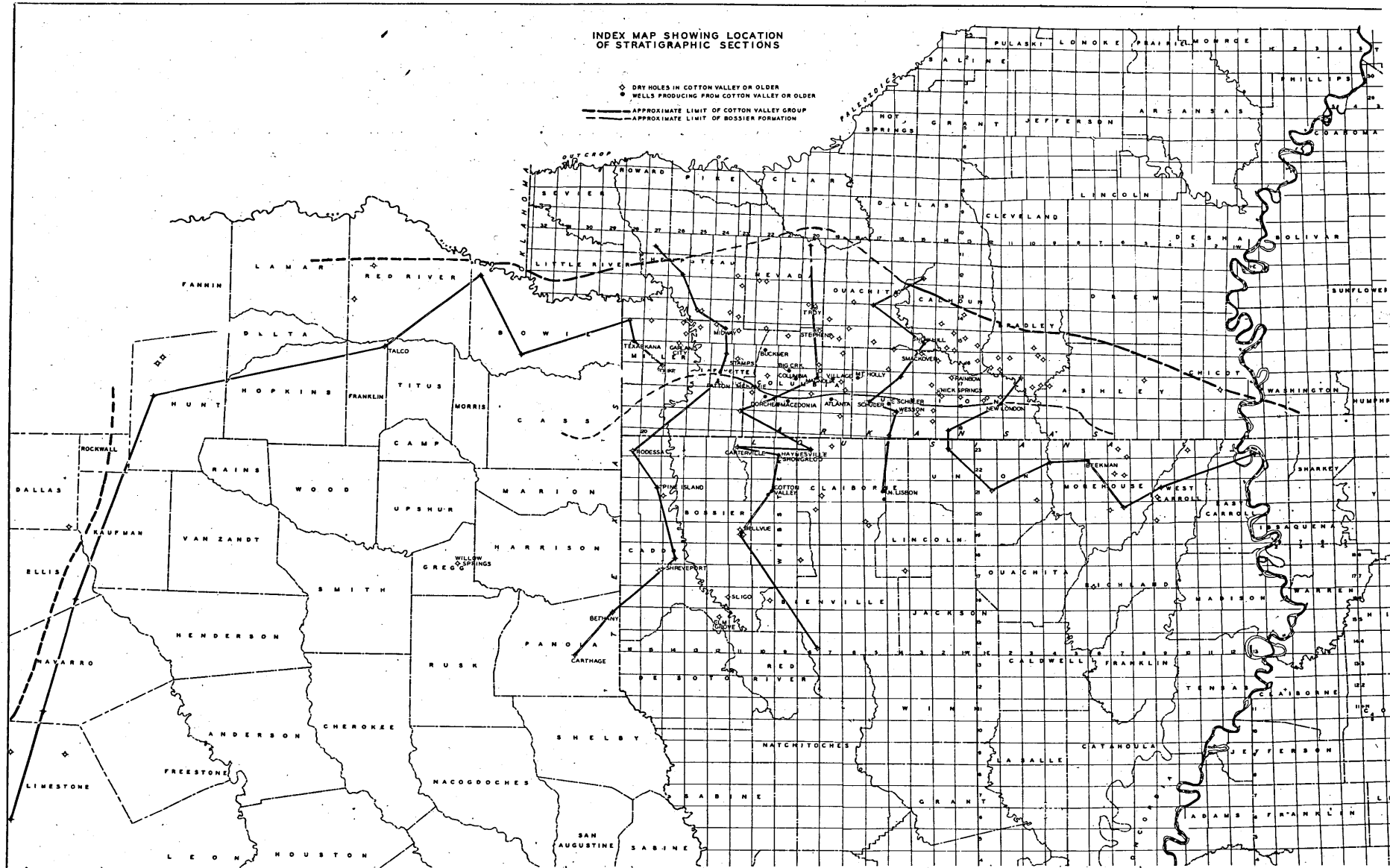
## BOSSIER FORMATION

Definition: The Bossier formation includes the marine, dark gray to black shale and sandstone, and the shoreward equivalents of these rocks lying beneath the Schuler formation and above the Buckner formation or its basinward equivalent. The formation is named from Bossier Parish, of northwestern Louisiana and the type locality is the Bellevue Oil Field in east-central Bossier Parish (plate II).

Distribution: In northern Louisiana, the Bossier formation has been found by drilling in Caddo, Bossier, Claiborne, Lincoln, Union, Morehouse, East Carroll and West Carroll Parishes. To the south, wells have not yet penetrated deep enough to reach it. In southern Arkansas, the Bossier is present in, roughly, the southern half of Miller, Lafayette, Columbia, and Union Counties. To the east, the occurrence of the Bossier has not been defined by drilling. To the north, in southern Arkansas, the Bossier is absent probably in large part as a result of pre-Schuler erosion (plate II). In Eastern Texas, the Bossier is present in Panola County, adjacent to Louisiana (plate VII). To the northwest, a well drilled in the Talco Field of northeastern Franklin County may have encountered a thin section of Bossier. Elsewhere in the East Texas Basin, there is no definite knowledge of the Bossier formation, but it may underlie most of the East Texas Basin. A deep well in Clarke County, western Alabama, probably encountered rocks of Bossier age.

Thickness: The Bossier formation varies in thickness from a knife-edge where it is overlapped by the Schuler formation to almost 2000 feet on the flank of the North Lisbon Field in east-central Claiborne Parish, Louisiana. At the type locality in the Bellevue Oil Field, Bossier Parish, Louisiana, the Bossier formation is 1635 feet thick. In contrast with the relative uniformity in thickness of the Schuler formation, the thickness of the Bossier

### INDEX MAP SHOWING LOCATION OF STRATIGRAPHIC SECTIONS





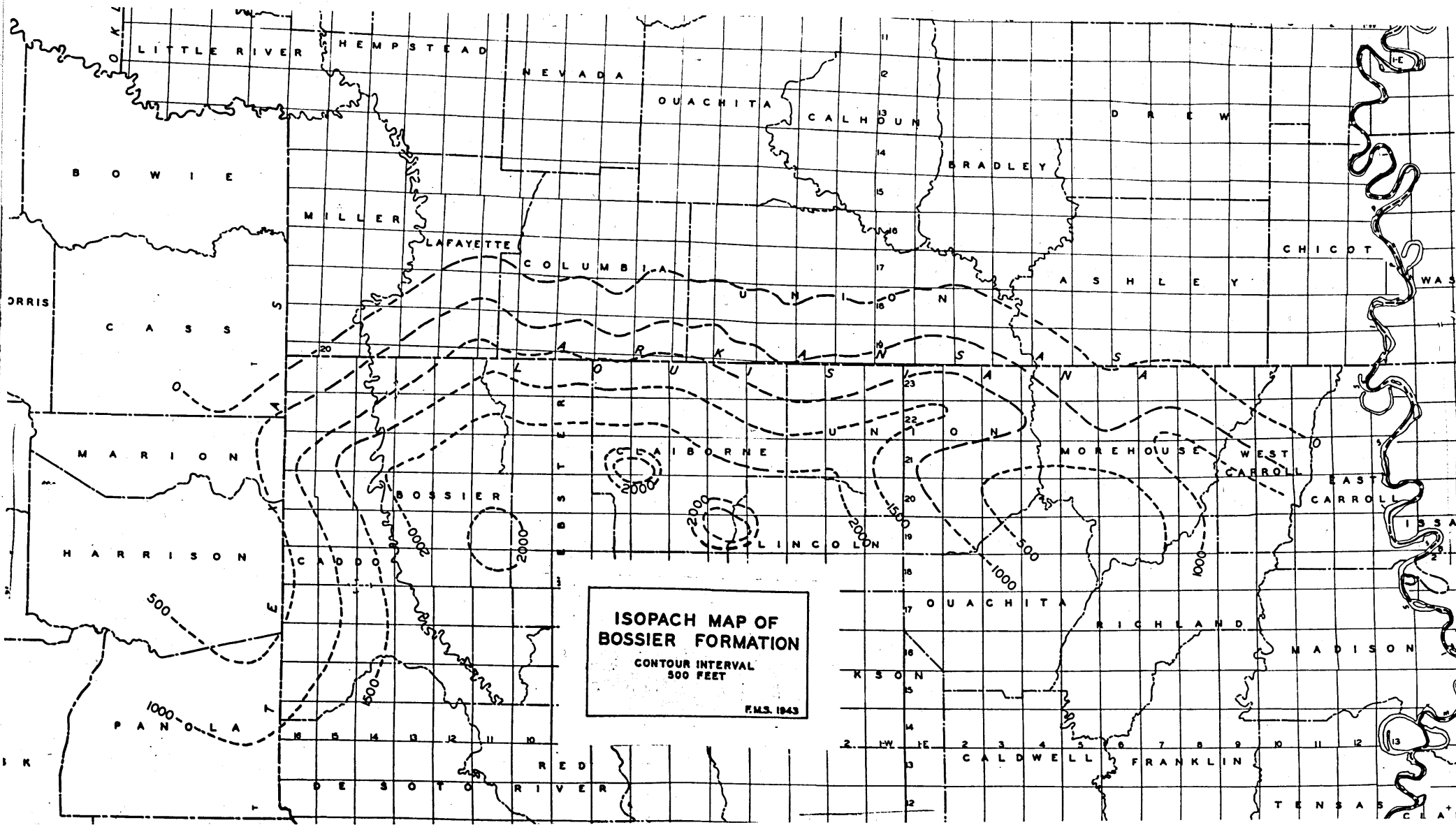
formation in northern Louisiana and southernmost Arkansas is highly variable. In general, it thickens southward, at an average rate of about 125 feet per mile. North of township 21 north, Louisiana, the Bossier probably has undergone pre-Schuler erosion, as explained on following pages, so that its original thickness cannot be determined. Consequently, the original rate of basinward thickening of the Bossier was much less than the figure given. The reader is referred to the Bossier isopach map (plate III) for known thicknesses of the formation.

Lithologic Character: At the type locality in the Bellevue Oil Field, Bossier Parish, Louisiana, the Bossier consists almost entirely of dark-gray to black, calcareous, ammonite-bearing shale, with a few thin layers of dark, argillaceous limestone, and near the top, a little sandstone [plate IV]. In this section, the Bossier passes downward, imperceptibly, into interbedded dark argillaceous limestone and shale which may be the offshore equivalent of the Buckner red shale and anhydrite formation. Below these probable Buckner equivalents are dark-argillaceous, limestones which represent the Smackover formation.

In wells drilled in Caddo Parish, Louisiana, at Rodessa (Norton No. 1 Payne, Sec. 27, T. 23 N., R. 16 W.) and at Pine Island (Stanolind No. 1 Dillon Heirs, Sec. 14, T. 21 N., R. 15 W.), in Panola County, Texas, at Bethany (Texas No. C-1 Adams, Cox Survey) and in southeastern Claiborne Parish, Louisiana at Sugar Creek (Union Prod. Co. No. 2 Brownfield, Sec. 5, T. 19 N., R. 5 W.), the Bossier formation is made up almost entirely of dark-gray to black shale, as at the type locality. A deep test in the old Homer Oil Field of eastern Claiborne Parish, Louisiana, the Frankel Bros. No. 1 Muslow, Sec. 30, T. 21 N., R. 7 W., encountered oolitic limestone in the lower part of the Bossier formation.

To the north and east, the Bossier undergoes a change in lithology.

In the North Lisbon Field of east-central Claiborne Parish, Louisiana, and



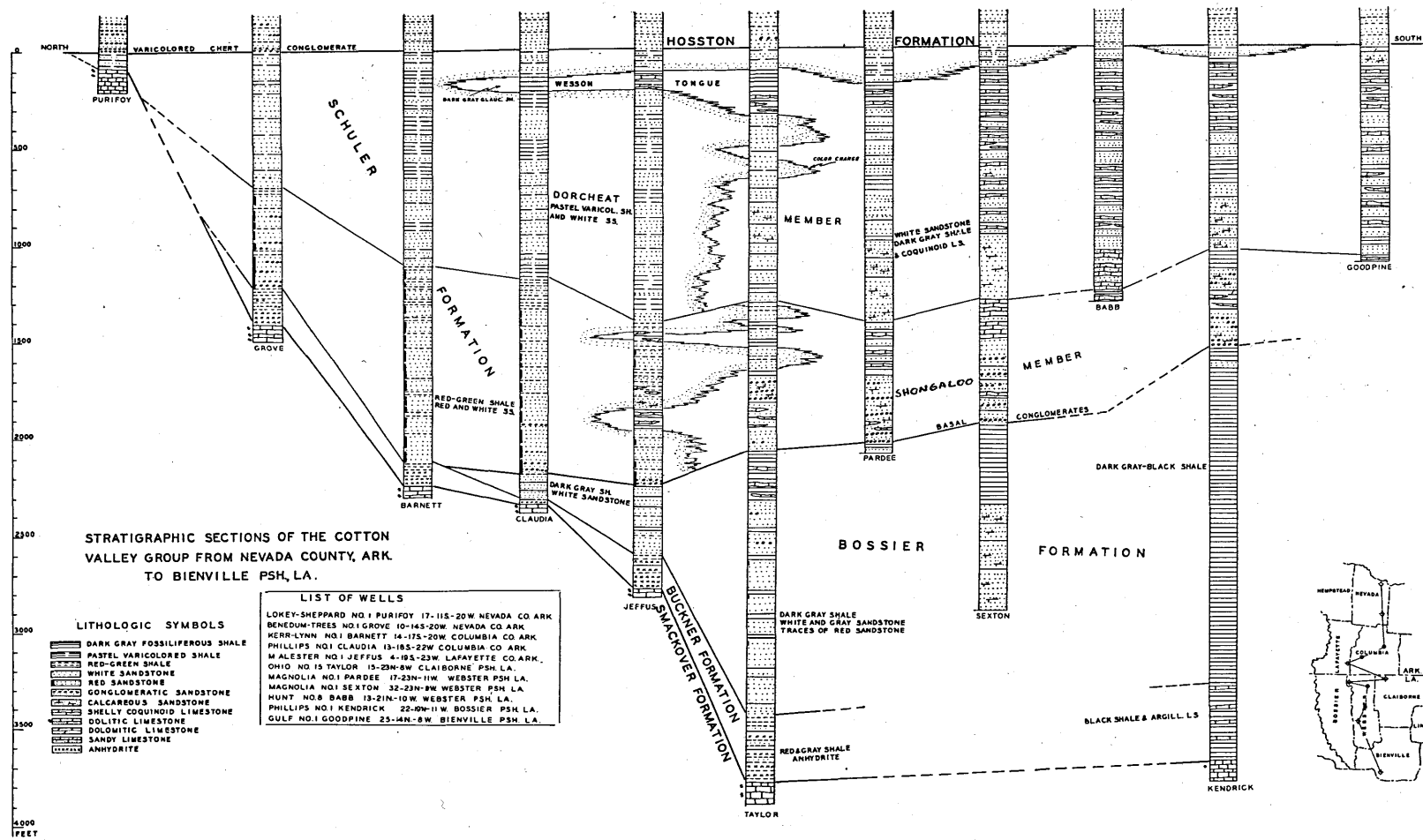
ISOPACH MAP OF  
BOSSIER FORMATION  
CONTOUR INTERVAL  
500 FEET  
F.M.S. 1943

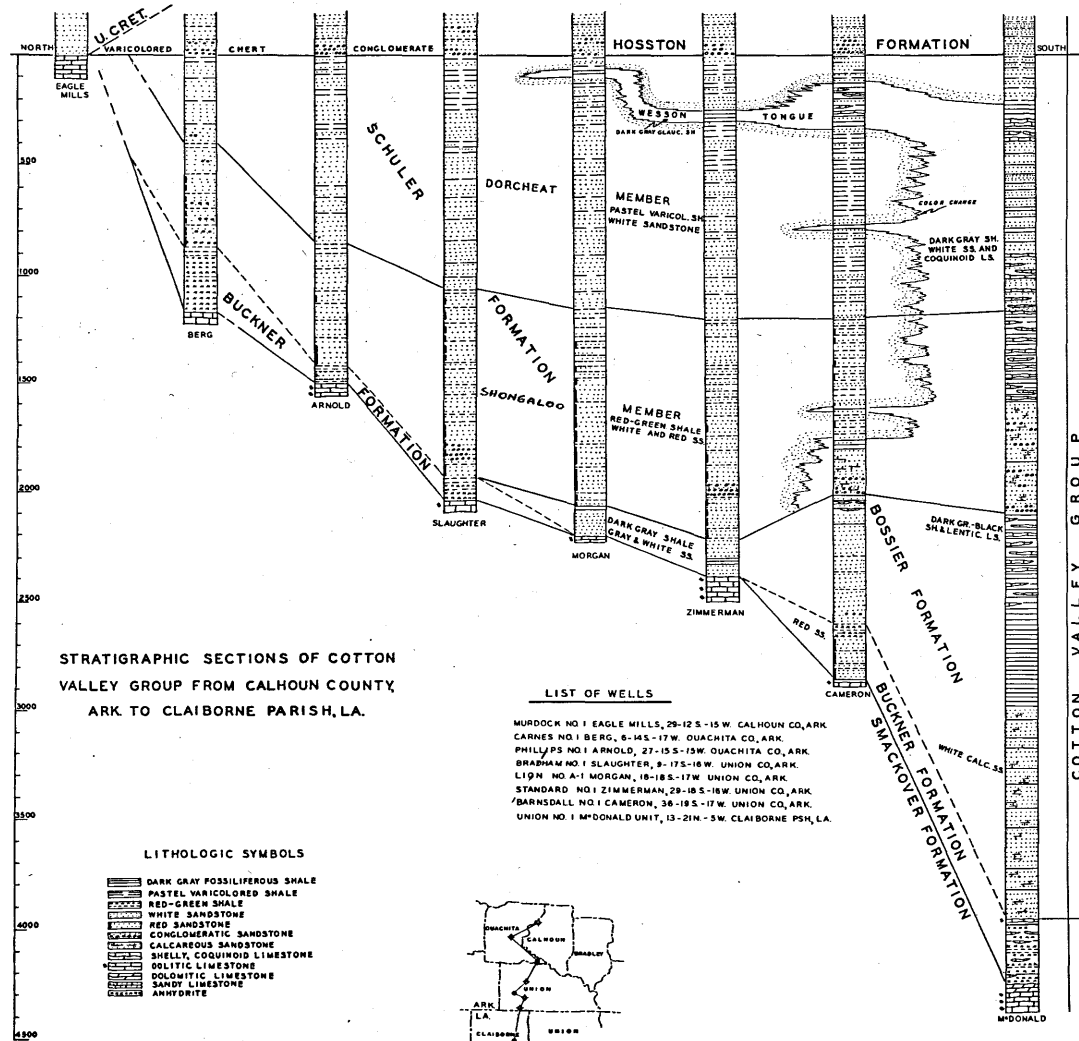
in the Haynesville Field in northwestern Claiborne Parish, (plates IV and V), the lower one-half to two-thirds of the Bossier consists of mostly fine-grained white and gray, in part fossiliferous, calcareous sandstone, interbedded with dark, fissile shale. The upper one-third to one-half of the Bossier in these two localities is dark fissile shale interbedded with thin layers of limestone.

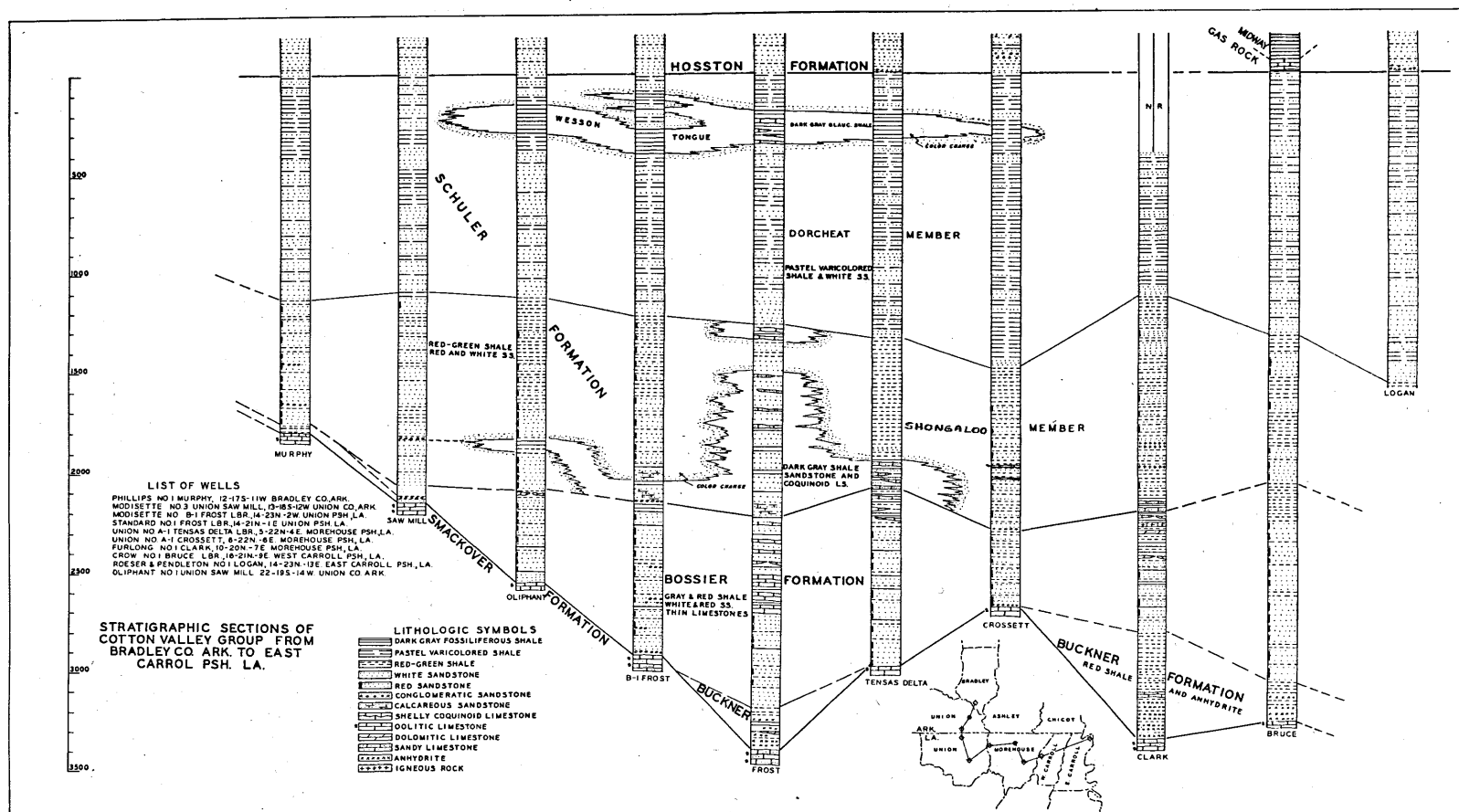
To the north, in southern Arkansas, the Bossier consists principally of fine to medium-grained, gray and white sandstone, which contrasts with the unconformably overlying coarser, reddish sandstones of the basal Schuler formation (plates IV and V). Interbedded with the Bossier sandstones in southern Arkansas are shales which are for the most part dark, but in southeastern Lafayette County, Arkansas in the McAlester No. Jeffus, Sec. 4, T. 19 S., R. 23 W., there is some red shale in the lower Bossier formation (plate IV).

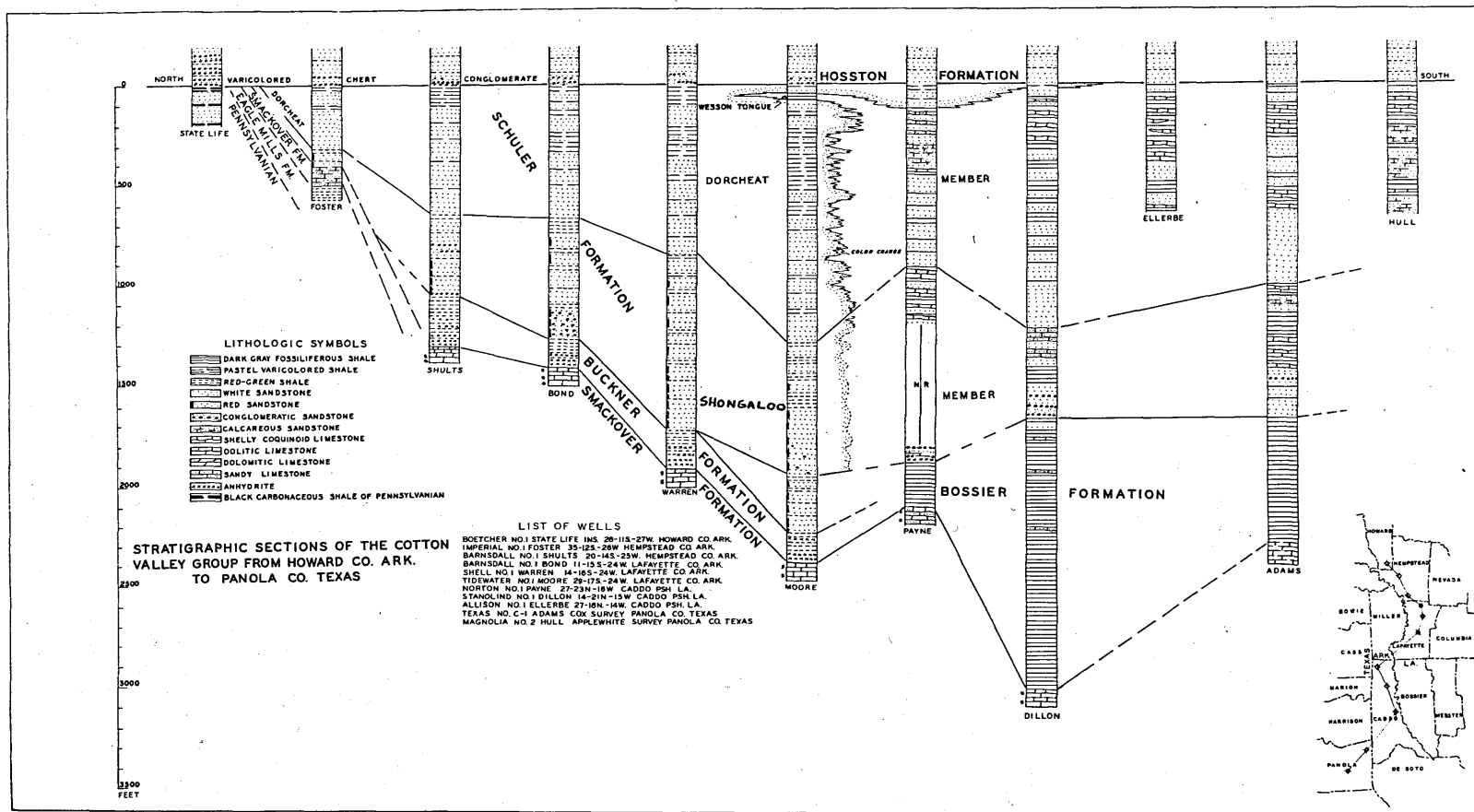
East of Claiborne Parish, Louisiana, toward the Monroe Platform, the Bossier formation passes by interfingering into red beds of probable non-marine character (plate VI). Where the Bossier formation consists entirely of red beds as in the Crow No. 1 Bruce Lbr. Co., Sec. 16, T. 21 N., R. 9 E., West Carroll Parish, Louisiana, the contact between the Bossier formation and the overlying Schuler formation is difficult to determine, and one must resort to parallelism to pick the top of the Bossier. It is believed that detailed petrographic study of the Cotton Valley sediments would be valuable in this area.

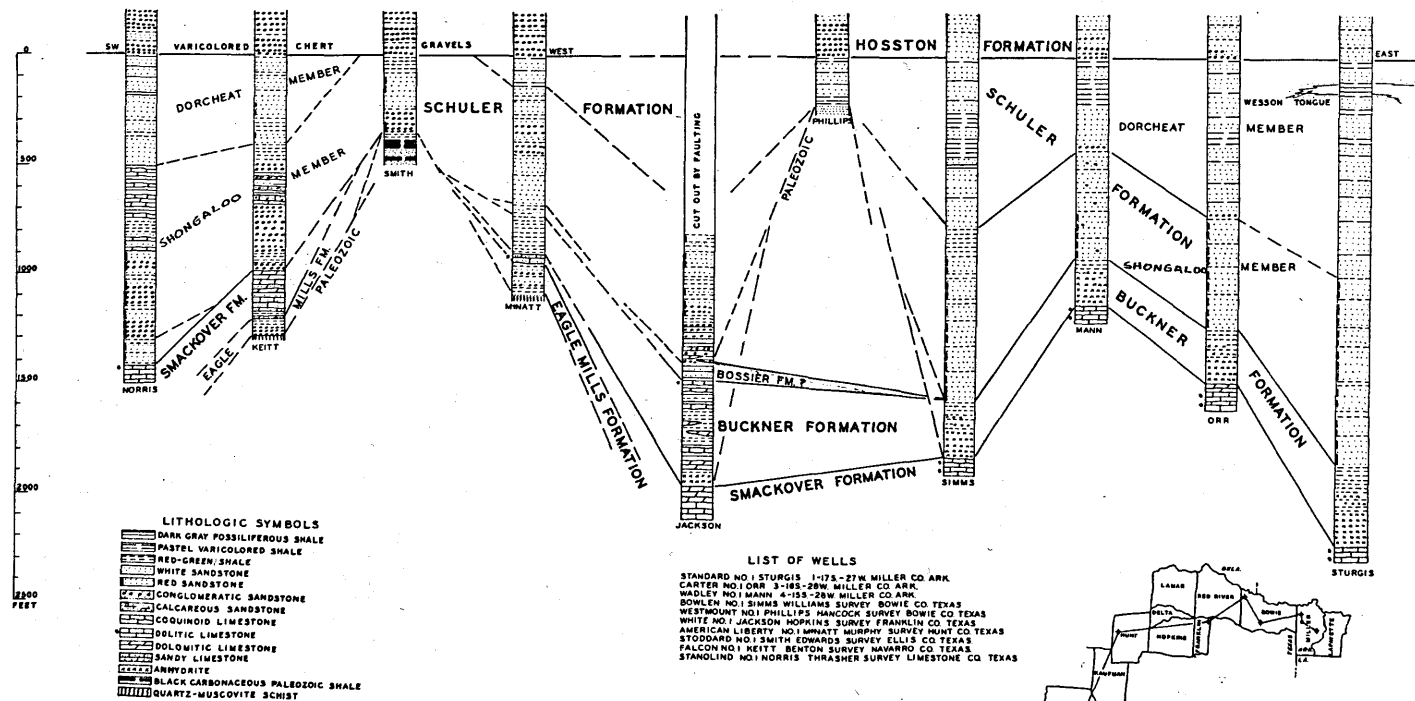
Aside from the occurrence of Bossier shales in Panola County, there is no certain knowledge of the formation in East Texas. It is probable, however, that the Bossier may be present in most of the East Texas Basin area, but it has not yet been reached by drilling. A deep test drilled in the Talco Field of northeastern Franklin County (White and Vaughn No. 1 Jackson, Hopkins Survey) encountered about 75 feet of section which may represent the





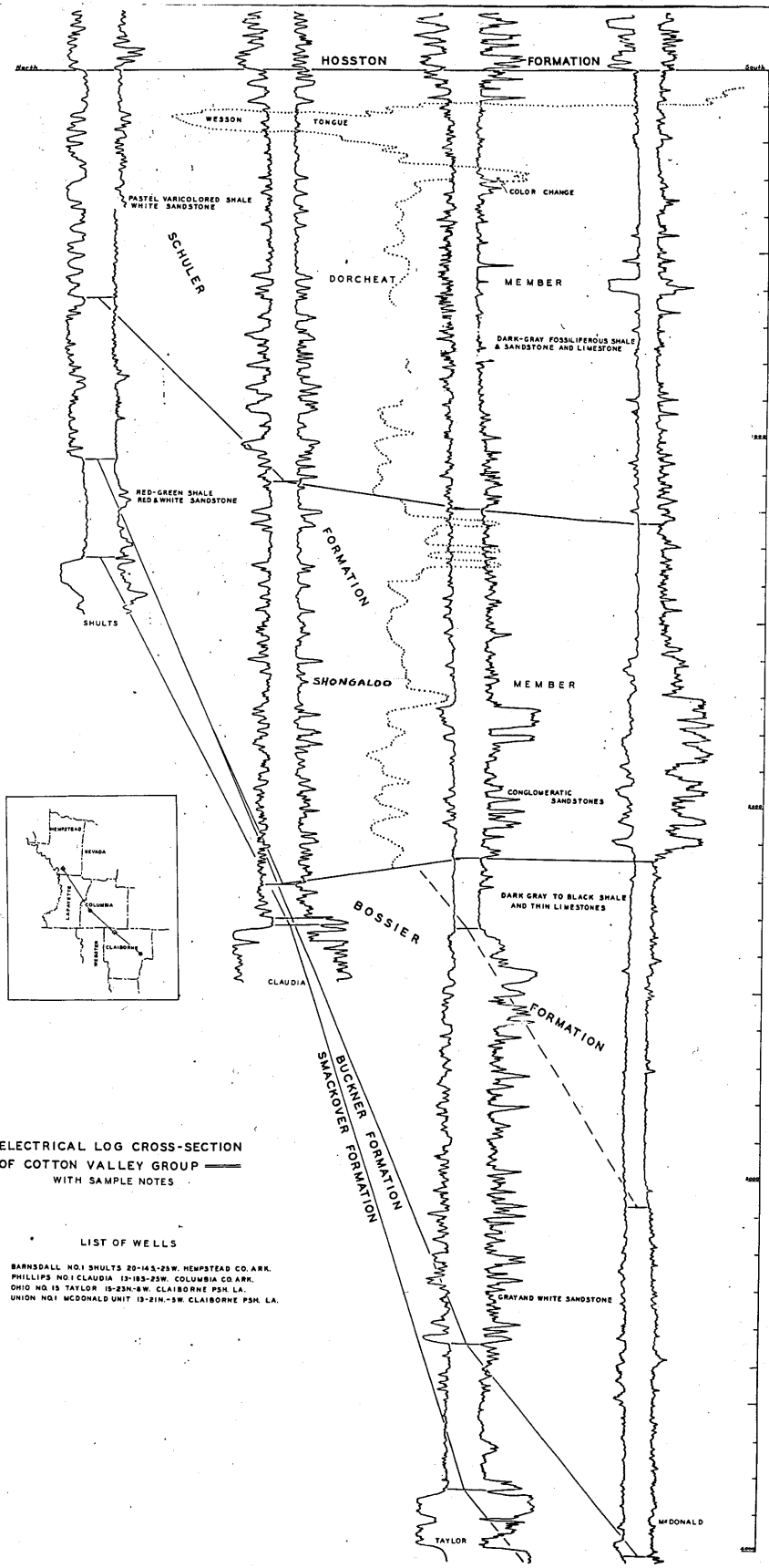






STRATIGRAPHIC SECTIONS OF THE COTTON VALLEY  
 GROUP FROM MILLER CO. ARK. TO LIMESTONE CO.  
 TEXAS





ELECTRICAL LOG CROSS-SECTION  
OF COTTON VALLEY GROUP  
WITH SAMPLE NOTES

LIST OF WELLS

BARNSDALL NO.1 SHULTS 20-145-25W. HEMPSTEAD CO. ARK.  
 PHILLIPS NO.1 CLAUDIA 13-183-25W. COLUMBIA CO. ARK.  
 OHIO NO.1 TAYLOR 15-23N-8W. CLAIBORNE PSN. LA.  
 UNION NO.1 MCDONALD UNIT 13-21N-5W. CLAIBORNE PSN. LA.

Bossier. This consists of fine-grained gray sandstone and dark shale lying beneath conglomeratic sandstones and limestones of the Schuler formation and above a well developed and unusually thick Buckner section (plate VIII).

There is little knowledge of the Bossier formation east of the Mississippi River. The Union Producing Company No. 1 Waits, a wildcat in Sec. 27, T. 8 N., R. 1 W., Clarke County, Alabama, penetrated the Cotton Valley Group. A section of fine to coarse-grained red sandstones and red shales from 10,160 to 11,660 feet may represent the Bossier formation. These rocks are overlain by conglomerate beds which are thought to represent the Shongaloo member of the Schuler formation.

The type section of the Bossier formation is given below:

Type section - Bossier Formation

Phillips Petroleum Company No.1 Kendrick, C NE SW, Sec.22, T. 19 N., R. 11 W., Bossier Parish, Louisiana, Bellevue Field deep test.

Lithology

Depth

Thickness

COTTON VALLEY GROUP

SCHULER FORMATION

(lower part)

Sandstone; white and gray, fine to coarse-grained, conglomeratic, calcareous, fossiliferous, with interbedded coquinoid, in part sandy, limestone and silty gray calcareous shale. Pebbles are of quartz and dark gray chert, are well rounded and up to an inch in diameter. Imley has identified Pseudomonitis durangensis from core 6367-82 and P. durangensis and Corbicella? sp. from core samples at 6488.

6330-6505

175

BOSSIER FORMATION

Shale; very dark gray, silty, with pyrite clusters and trace very fine gray sandstone.  
Sandstone; light gray, fine tight calcareous.  
Shale; dark-gray to black silty micaceous carbonaceous and dark gray calcareous siltstone, fossiliferous.

6515  
6525  
6582

10  
10

57

(cont'd) BOSSIER FORMATION:

Sandstone; light gray, silty, calcareous fine-grained with dark grains.	6600	18
Shale; dark-gray to black, silty, calcareous, with small involute Foraminifera.	6815	215
Shale; dark gray to black, silty, calcareous, and dense argillaceous dark gray limestone with Foraminifera as above; trace fine white calcareous sandstone.	6955	140
Shale; dark gray to black silty, calcareous with vein calcite which is in part asphaltic., Foraminifera, few Ostracoda, <u>Astarte</u> sp., gastropods.	7440	485
Shale; dark gray to black, silty with vein calcite and dark argillaceous limestone, Foraminifera, <u>Astarte</u> sp., Bryozoa. Im-lay has identified the following species from cores: <u>Metahaploceras</u> cf. <u>M. nereus</u> (Fontannes) 7654-64; <u>Idoceras</u> cf. <u>I. durangense</u> Burckhardt, <u>Idoceras</u> cf. <u>I. lorioli</u> Burckhardt, <u>Glochiceras</u> cf. <u>G. fialar</u> (Oppel), <u>Taramelliceras</u> ? sp., <u>Haploceras</u> sp., <u>Physodoceras</u> ? sp., <u>Lamellaptychus</u> sp., <u>Pteroperma</u> ? sp., Pelecypods on carbonized material, fish scales, fish skull bones 8048-63. This core of black shale had faint hydrocarbon odor on fresh break.	8140	700

BUCKNER FORMATION?

Shale; black, calcareous	8230	90
Shale; dark gray to black, grading downward into dense to finely crystalline argillaceous limestone. Im-lay identified the following species from cores: <u>Ataxioceras</u> sp. <u>Idoceras</u> sp. <u>Astarte</u> sp., <u>Astarte brevicola</u> Cragin, fish scale, core 8279-94; <u>Idoceras</u> (Sub-nebrodites)? cf. <u>I. planula</u> (Zieten), <u>Ataxioceras</u> ? sp., Core 8377-92.	8627	397

SMACKOVER FORMATION

Limestone; dark gray to black, silty, argillaceous; a trace of oolitic structure present at top becomes dolomitic and banded toward base. The following fossils have been identified by R. W. Im-lay: <u>Discosphinctes</u> cf. <u>D. virgulatus</u> (Quenstedt), <u>Discosphinctes</u> cf. <u>D. lucingensis</u> (Choffat), <u>Dichotomosphinctes</u> ? cf. <u>D. plicatilis</u> (De Riaz), <u>Lamellaptychus</u> sp., <u>Lima</u> ( <u>Flagiostoma</u> ) sp., rhynchonellid brachiopod, fish scale. (core 8741-56).	9038	411
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Stratigraphic Relationships: South of township 21 north in Louisiana, the Bossier formation may be conformably overlain by the Schuler formation. Further drilling, however, is necessary to make this relationship certain. North of township 21 north, Louisiana, as far as the limit of the Bossier in southern Arkansas, the Schuler rests with probable angular unconformity upon the Bossier (plates IV, V and IX). In other areas, the relationship between the Schuler and the Bossier is not yet clear.

The relationship between the Bossier formation and the underlying Buckner formation is not well understood. In certain areas, the Bossier rests directly upon the Smackover limestone. At the Schuler Oil Field, a thin layer of conglomerate was cored at the base of the Jones sand (basal Bossier) which rests upon Smackover limestone.<sup>9</sup> This same condition exists in the small Beekman Field in north-central Morehouse Parish, Louisiana.<sup>10</sup> In other areas, there is full development of the Buckner beneath lower Bossier sandstones. The writer knows of no definite evidence of disconformity between the Bossier and Buckner formations where these formations are in contact. A detailed study of Smackover and Buckner stratigraphy is necessary, however, before the relationships of these two formations to the Bossier can be adequately determined.

Paleontology: R. W. Inlay<sup>11</sup> has identified the following megafossils from cores in the Bossier formation: Metahaploceras cf. M. nereus (Fontannes), Idoceras cf. I. durangense Burckhardt, Idoceras cf. I. lorioli Burckhardt, Idoceras cf. I. complanatum Burckhardt, Glochiceras cf. G. falar (Oppel), Taramelliceras ? sp., Haploceras sp., Physodoceras ? sp., Lamalleptychus sp., Pteroperna sp., Aulacomyella sp. The microfauna of the Bossier

9- Weeks, W. B.; personal communication.

10- Alexander, C. W.; *ibid.*

11- Inlay, R. W.; written communication.

formation has not been described or completely studied. These are several species of Foraminifera and Ostracoda in the writer's collections.

Age and Correlation: Dr. Imley<sup>12</sup> believes that the above assemblage of megafossils furnishes a correlation with the middle Kimmeridgian of Mexico.

## SCHULER FORMATION

Definition: The updip, essentially red-bed portion of the Cotton Valley has been called the Schuler facies by Weeks,<sup>13</sup> Hazzard,<sup>14</sup> and Imley.<sup>15</sup> It is proposed here that the name be redefined as Schuler formation to include the nearshore or nonmarine pastel, and red-green shales, sandstones and basal conglomerates and the offshore equivalents of these rocks, which are dark gray fossiliferous shales, limestones, sandstones, and basal conglomerates, lying stratigraphically between the base of the Hosston formation and the top of the Bossier formation. The type locality is the Schuler oil field in Union County, Arkansas.

As in previous usage of "Schuler" the present definition includes practically all the Cotton Valley beds in southern Arkansas, as the underlying Bossier formation extends only a short distance north of the Arkansas-Louisiana state line (plate II).

Distribution: In southern Arkansas, the Schuler formation is present in Miller, Lafayette, Columbia, and Union Counties, in the southern half of Bradley, Calhoun, and Hempstead Counties, the southern two-thirds of Ouachita, and Nevada Counties, the southern one-third of Little River County, and is probably present beneath most of Ashley County and the southern half of Chicot County. North of these limits, the entire Cotton Valley Group is absent due to pre-Upper Cretaceous erosion. The northern limit of the Cotton Valley in southern Arkansas is shown on plate II, which is modified after illustrations by Weeks<sup>16</sup> and Imley.<sup>17</sup>

13- Weeks, W. B. op. cit. pp. 60, 66.

14- Hazzard, R. T.; op.cit. p. 156.

15- Imley, R. W.; op.cit. p. 25.

16- Weeks, W. B.; op.cit. p. 957.

17- Imley, R. W.; op.cit. plate XIV.

In northern Louisiana, the Schuler formation has been encountered by drilling only in Caddo, Bossier, Webster, Claiborne, Union, Morehouse, West Carroll, East Carroll, Richland, Lincoln, and Bienville Parishes, but probably extends much farther south.

In East Texas, the Schuler formation probably underlies the entire East Texas Basin, but at such great depths that only a few wells have reached it. On the east side of the basin, it has been identified in Panola County, and in Gregg County. On the north side of the basin it is present in Bowie County and in the southern two-thirds of Red River County. It has been found in northwestern Hunt County, but its limits on the northwestern flank of the basin are not certainly known. It may be present in eastern Ellis County and in the eastern two-thirds of Navarro and Limestone Counties. The southernmost well in East Texas to encounter Cotton Valley is in southwestern Limestone County. Plate II shows the approximate limits of the Cotton Valley in East Texas.

A deep well drilled on the Jackson uplift in eastern Hinds County, Mississippi, penetrated pre-Upper Cretaceous rocks which Monroe<sup>18</sup> assigned to the Comanchean. The writer and others believe that the lower part of this well penetrated the Cotton Valley (Schuler formation). A deep well in Scott County, Mississippi, probably penetrated the uppermost Schuler beds. A well recently drilled in Sec. 28, T. 5 N., R. 13 E., Newton County, Mississippi, encountered a thick section of limestone lying beneath basal Comanchean conglomerates and separated from the conglomerates by layers of interbedded variegated shale with ankerite and reddish limestone. Part of this section may be of Cotton Valley age. Rocks which

18- Monroe, W. H. and Toler, H. E.; The Jackson gas field and the state deep test well; Miss. State Geol. Surv. Bull. 36, 1937.

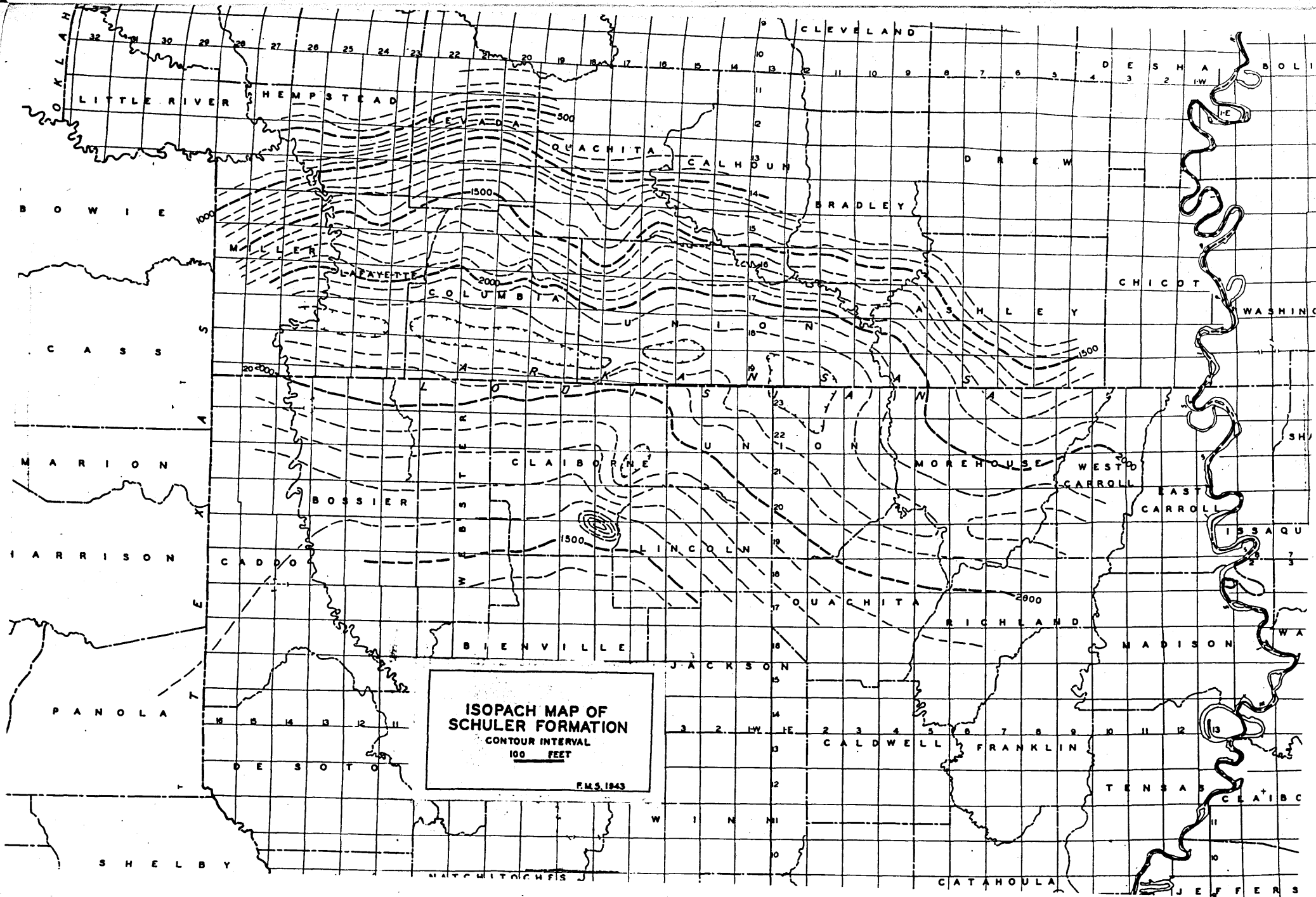
probably represent the entire Cotton Valley Group have been found in a wildcat drilled in Clarke County, western Alabama. Elsewhere, east of the Mississippi River, there is no certain information on the Cotton Valley rocks.

Thickness: The isopach map of the Schuler formation (plate X) shows the approximate thickness of the Schuler formation in southern Arkansas, northern Louisiana, and northeastern Texas. In general, the Schuler formation in southern Arkansas thickens southward from the line of its pre-Upper Cretaceous truncation at the rate of about 50 feet per mile. The thinnest section of Schuler noted is in the Lokay-Sheppard No. 1 Purifoy, Sec. 17, T. 11 S., R. 20 W., Nevada County, Arkansas, where it is only 47 feet thick. How much Schuler has been removed by pre-Gulf erosion in this northern area is uncertain, but judging from the northward thinning within the Schuler, removal of beds may not have exceeded 200 to 300 feet.

The Schuler formation attains its greatest known thickness in southern Columbia and Union Counties, Arkansas, and in northern Union and north-central Morehouse Parishes, Louisiana, where it is at least 2300 feet thick. South of these areas in northern Louisiana, the formation thins gradually. In southeastern Claiborne Parish, in the Sugar Creek Field, the Schuler is only a little over 1200 feet thick. In southwestern Lincoln Parish, at Simmsboro, it is only about 1400 feet thick.

Caution must be exercised, however, in interpreting Schuler thickness in northern Louisiana on the basis of present information. Most of the wells drilled to the Cotton Valley in this area have been on prominent domal structures. Some of the present-day structural uplifts may also have been positive areas during Schuler time resulting in a thinner section over the tops of the structures than in surrounding areas.





Facies of the Schuler formation and principal subdivisions:

The Schuler formation includes two lithologic facies distinguished mainly by colors. Weeks, summarizing the conclusions reached by geologists in the area, wrote that the (nearshore) varicolored and red shales and sandstones lying beneath the Travis Peak red shales and coarse sands in the Schuler field of Arkansas were equivalent to the (offshore) fossiliferous shales, sandstones, and limestones beneath the Travis Peak in the Cotton Valley Field and other areas of northern Louisiana.<sup>19</sup> These color changes are indicated on plates IV to IX.

The Schuler formation in southern Arkansas may be divided into two members. The upper member, herein named the Dorcheat, includes a little more than half the formation and attains a thickness of more than 1200 feet in its fullest development. It is composed principally of pastel, varicolored shales or claystones, siltstones, and white sandstones. Marine fossils have not been observed by the writer except in a thin tongue of dark gray, partly glauconitic shale near the top of the member. In most places, the upper one-third of the Dorcheat member is predominantly shale and the lower two-thirds predominantly sandstone.

The lower member of the Schuler formation, herein named the Shongaloo member, attains a thickness in southern Arkansas of more than 1000 feet, but averages thinner than the overlying Dorcheat member. In southern Arkansas, it consists of red and red-green shales of darker color than the Dorcheat shales, of red and white sandstones, and of conglomerates that are widespread in its lower part.

Basinward in northern Louisiana, the two members of the Schuler formation pass into dark gray, shell-bearing shales, limestone, and sandstone, but conglomerates persist in the lower part of the Shongaloo member. This color

<sup>19</sup>- Weeks, W. B.; op.cit. p. 966. (The term Eosston has now been substituted for Travis Peak in southern Arkansas and northern Louisiana, but "Travis Peak" is still used by geologists in East Texas for the pre-Trinity ? Cretaceous red beds of the East Texas Basin.)

change takes place very near the Arkansas-Louisiana state line. The updip facies of both members of the Schuler formation will hereinafter be referred to as the nearshore facies, and the basinward definitely marine facies will be referred to as the offshore facies. The offshore Schuler rocks were deposited in a shallow water marine environment that supported abundant oysters and other life. The nearshore Schuler rocks were deposited in a fresh or brackish water environment which probably was unfavorable to bottom dwelling organisms.

In the area affected by the Monroe uplift in eastern Union, Morehouse, West Carroll, and East Carroll Parishes, Louisiana, the Schuler formation is characterized by the nearshore facies. Elsewhere in Louisiana, the Schuler consists predominantly of the offshore facies. In East Texas, both members of the Schuler are recognizable, but the facies relationships are not yet clear in this area, because only a few wells have penetrated the Cotton Valley there. The type section of the Schuler formation and some of the adjoining beds is given below.

Type section - Schuler formation; nearshore facies. Lion Oil Company and Phillips Petroleum Company No. 1 Edna Morgan, C NE/4 SW/4, Sec.18, T. 18 S., R. 17 W., Union County, Arkansas.

<u>Lithology</u>	<u>Depth</u>	<u>Thickness</u>
HOUSTON FORMATION (basal beds)		
Sandstone; white, coarse, conglomeratic, some inter-bedded red silty shale.	5325-5385	60
<u>COTTON VALLEY GROUP</u>		
SCHULER FORMATION		

(cont'd)

Dorchester Member (nearshore facies)

Shale; pale gray, with streaks white siltstone.	5410	25
Sandstone; white, fine, angular, porous.	5417	7
Shale; pale, varicolored, trace ankerite, streaks of siltstone.	5485	68
Sandstone; white, fine, angular, porous, pyritic.	5500	15
Shale; dark gray, glauconitic, with streaks of argillaceous siltstone (herein named Wesson Tongue), fossiliferous	5520	20
Sandstone; white, very fine to fine-grained, silty, carbonaceous.	5535	15
Shale; dark gray, with sandy dolomitic streaks.	5550	15
Sandstone; fine, porous with oil stain, some interbedded pale gray shale.	5560	10
Shale; pastel, varicolored, with brown and reddish-brown ankerite, streaks of white siltstone.	5750	190
Sandstone; white, fine, porous to silty.	5760	10
Shale; pastel, varicolored, with streaks of sandstone.	5795	35
Sandstone; white, fine, porous, show of oil.	5825	30
Shale; pastel, varicolored, ankerite, streaks of siltstone.	5925	100
Sandstone; white, fine, angular, porous.	5940	15
Shale; pastel, varicolored.	5980	40
Sandstone; white, fine, angular, porous.	5990	10
Shale; pastel, varicolored.	6000	10
Sandstone; white, fine, angular, porous.	6015	15
Shale; pastel, varicolored.	6030	15
Sandstone; fine, white, angular, porous.	6055	25
Shale; pastel, varicolored.	6060	5
Sandstone; fine, white, angular, porous, shaly.	6080	20
Shale; pastel, varicolored.	6100	20
Sandstone; white, fine, lignitic.	6125	25
Siltstone; white, lignitic.	6150	25
Shale; pastel, varicolored.	6190	40
Sandstone; white, fine, angular, silty to porous, slight oil stain.	6225	35
Shale; pastel, varicolored, ankeritic.	6235	10
Sandstone; white, porous, in part dolomitic, carbonaceous.	6270	35
Shale; pastel, varicolored.	6315	45
Sandstone; white, fine, dolomitic.	6325	10
Shale; pastel, varicolored.	6335	10
Sandstone; white, fine, angular, porous, carbonaceous, pyritic.	6370	35
Shale; pastel, varicolored.	6405	35
Sandstone; white, fine, silty to porous.	6445	40

Shongaloo Member (nearshore facies)

Shale; red, silty.	6460	15
Sandstone; white, silty, tight, oil stain.	6490	30
Shale; red, silty.	6510	20
Sandstone; white, porous, silty.	6525	15

(cont'd) Shongaloo Member

Shale; red, silty, sandy, carbonaceous, with streaks argillaceous sandstone	6600	75
Sandstone; white, very fine to fine, with nodular dolomite.	6610	10
Shale; red, silty, with dolomite nodules.	6630	20
Sandstone; white, fine, lignitic.	6635	5
Shale; red, silty, with dolomite nodules, streak of red, argillaceous, fine sandstone.	6675	40
Sandstone; white, fine, slightly porous, lignitic, streaks red shale.	6750	75
Shale; red, silty, with streaks of fine white silty sand, and nodular dolomite.	6845	95
Sandstone; white, medium-grained, fairly porous, asphaltic.	6855	10
Shale; red, silty, with streaks of fine red, argillaceous sandstone.	6905	50
Sandstone; white, medium-grained with dark chert grains, streaks red shale, asphaltic.	6920	15
Shale; red, silty, streaks of fine red and white sandstone.	6990	70
Sandstone; red, fine to medium-grained, with nodular dolomite, in part carbonaceous.	7145	155
Shale; red, silty and dark gray interbedded.	7180	35
Sandstone; red, medium-grained, carbonaceous, with dark chert grains, some interbedded red shale.	7275	95
Shale; red, silty, some dark gray shale, interbedded.	7290	15
Sandstone; red, medium-grained carbonaceous.	7335	45
Shale; red, silty.	7340	5
Sandstone; red, medium-grained.	7355	15
Shale; red, silty.	7375	20
Sandstone; red, fine to medium-grained, some white sandstone interbedded.	7475	100

BOSSIER FORMATION

Shale; dark gray, pyritic, with some interbedded very fine-grained white sandstone.	7500	25
Sandstone; white and gray, fine-grained, oil stain (Jones producing sand)	7575	75
Shale; dark, gray.	7585	10
Sandstone; light gray, fine-grained, oil stain, conglomerate at base in other wells (Jones producing sand)	7600	15

SMACKOVER FORMATION

Limestone; dense, gray-brown	7603	3
Shale; greenish-gray, silty.	7604	1
Limestone; gray-brown, oolitic, tight to slightly porous.	7686	82

TOTAL DEPTH

Paleontology: R. W. Imlay<sup>20</sup> has identified the following megafossils from rocks herein assigned to the offshore facies of the Schuler formation: Nuculena sp., Exogyra sp., Cryphea sp., Pseudomonotis duranensis (Imlay), Astarte cf. A. breviscola Cragin, Tencredia louisianensis Imlay, T. texana Imlay, Quenstedtis sp., Protocardia sp. In addition, abundant Ostracoda and a few Foraminifera occur in the Schuler, but have not been adequately studied. L. W. Calahan<sup>21</sup> has identified the following microfossils: Haplophragmoides 2 spp., Ammobaculites sp., Quinqueloculina sp., Cuttulina sp., Cythere 3 spp., Cytherella, sp., Cytherides 2 spp., Loxoconcha sp., Paracypris sp., Jonesina sp.

Age and Correlation: The Schuler formation rests unconformably on the Bossier formation from which Imlay has identified late Kimmeridgian fossils.<sup>22</sup> The Schuler formation contains pelecypods of definite Upper Jurassic age and probably represents the Portlandian and Tithonian stages according to Imlay.<sup>23</sup>

20- Imlay, R. W.; Jurassic Fossils from Arkansas, Louisiana, and East Texas; Journal of Paleontology, vol. 15, No. 3, May, 1941, pp. 256-277.

21- Calahan, L. W.; Diagnostic Fossils of the Ark-La-Tex area; Shreveport Geol. Soc. Guidebook, 14th Annual Field Trip, 1939, pp. 28-36.

22- Imlay, R. W.; written communication.

23- Ibid.

DETAILED DESCRIPTION OF SCHULER MEMBERS

SHONGALOO MEMBER

Definition: The Shongaloo member includes the nearshore facies of red and red-green shales, red and white sandstones and basal conglomerates, and the basinward offshore equivalents of these rocks, which are dark gray fossiliferous shales, shelly limestones and sandstones, and basal conglomerates, lying beneath the Dorcheat member.

The type locality is the town and oil field of Shongaloo, Webster Parish, Louisiana (plate II). The discovery well for the deep (Cotton Valley) production in the Shongaloo Field is the Magnolia No. 1 Sexton, Sec. 17, T. 23 N., R. 11 W. The principal producing bed in this field, the "Sexton" conglomeratic sandstone, occurs in the lower part of the Shongaloo member. The type section belongs to the offshore facies (plate IV).

Distribution: The Shongaloo member is present in southern Arkansas, northern Louisiana, and northeastern Texas, but east of the Mississippi it has not been definitely recognized. It is overlapped by the Dorcheat member in northeastern Nevada County, Arkansas, (plate IV), and in northwestern Bowie County, Texas (plate VIII), probably owing to its non-deposition. Additional drilling may further limit the Shongaloo member in this marginal area.

Thickness: The Shongaloo member ranges in thickness from a feather-edge at its northern limit to over 1000 feet in parts of southern Columbia and Union Counties, Arkansas, and in eastern Morehouse Parish, Louisiana. It thins southward in Louisiana and at Bellevue in east-central Bossier Parish is only 500 feet thick. In east Texas, its thickness

averages about 600 feet in wells so far drilled, but attains 900 feet in southern Limestone County.

Lithologic character of nearshore facies: In southernmost Arkansas, the Shongaloo member consists typically of an upper shale unit including some interbedded sandstone, and a lower sandstone unit including a minor amount of interbedded shale. However, updip the member becomes increasingly sandy and in most wells north of T. 15 S. in Arkansas, it consists principally of sandstone (plates IV to IX).

The sandstones of the nearshore facies of the Shongaloo are fine to coarse-grained with interbedded conglomeratic layers. Individual beds are lenticular and cannot be traced very far laterally. The sands are in part white and in part red, the latter color being due to a coating of ferric oxide on the grains. The thicker, more massive sandstone layers tend to be white in color, while the thinner layers tend to be red. In some wells, however, the sandstones of the entire member may be red or reddish in color. The quartz grains of the sandstones are angular to sub-angular and many have overgrowths of silica, but secondary cementation by silica is uncommon. The porosity of the sandstones varies according to the amount of silt or clay present and the presence or absence of carbonate as a cementing material. The conglomeratic layers within the Shongaloo sandstones are composed of sub-angular to rounded fragments of quartz and gray and white chert mixed with finer grain sizes of these minerals. The conglomerate layers are so erratically distributed within the member that individual layers cannot be traced very far. Many of the sandstone beds contain light green, clayey grains, flakes of chloritic material, and some muscovite mica.

The shale of the nearshore facies of the Shongaloo is principally brick red in color, but includes some interbedded green shale. The red col-



or increases in amount updip. In some wells, a small amount of pastel, varicolored, ankeritic shale occurs in the upper part of the member, suggesting interfingering of the Shongaloo member with the overlying Dorchester member.

Varicolored, nodular, argillaceous limestone and dolomite occur in the red and green shales of the Shongaloo member as thin irregular layers of red, yellow, and brown color. No fossils have been observed.

Lithologic character of offshore facies: The offshore facies of the Shongaloo member typically comprises two units. The upper one-half to two-thirds of the member consists of interbedded shale and limestone and minor amounts of sandstone. The lower one-third to one-half consists of sandstone, in part conglomeratic, and some interbedded shale and limestone.

The sandstones are light gray to white in color, in part calcareous, oyster-bearing, thick to thin bedded, fine to coarse grained, and partly conglomeratic. The grains are somewhat better rounded than those of the nearshore facies sandstones. Dark gray chert grains are present in some layers.

The conglomeratic layers consist of mostly well-rounded pebbles of quartz and dark gray chert in a matrix of sandstone or shale. Typically (from core data) the pebbles are disseminated within the matrix rather than occurring in closely packed layers.

The shales are dark gray, fissile, in part sandy or silty, and include abundant oyster shells in some layers. Glauconite has been noted rarely in gray shales having irregular, rather than fissile, fracture. This irregular fracture is characteristic of the shales of the nearshore facies. In the zone of lateral transition from the nearshore facies to the offshore facies, occurs interfingering of red and green shale with dark gray, fissile,

shell-bearing shale.

The limestones of the Shongaloo member may be sandy, argillaceous, thin-bedded, or may consist of an oyster shell coquina.

The type section of the Shongaloo member is given below:

Type section - Shongaloo member.

Magnolia Petroleum Company No. 1 Sexton Unit, SW NW SE, Sec. 32,

T. 23 N., R. 9 W., Webster Parish, Louisiana; Shongaloo Field.

<u>Lithology</u>	<u>Depth</u>	<u>Thickness</u>
<u>COTTON VALLEY GROUP</u>		
SCHULER FORMATION		
Dorcheat Member (offshore facies) (lower part)		
Sandstone; white, fine-grained, calcareous.	8295-8315	20
Limestone; gray, coquinoïd, with oyster shells, interbedded with dark gray shale and calcareous sandstone.	8370	55
Sandstone; white, calcareous, shelly, fine-grained with streaks coquinoïd limestone and dark gray shale.	8400	30
Shongaloo Member		
Shale; dark gray, fissile, calcareous, fossiliferous.	8455	55
Limestone; gray, coquinoïd, probably thin-bedded, with thin interbedded layers of fine white calcareous sandstone and dark gray shale.	8885	430
Sandstone; white, medium to coarse grained, calcareous with dark gray chert grains, (Roseberry sand of Shongaloo Field).	8905	20
Limestone; gray, coquinoïd, sandy with thin layers of dark gray calcareous shale.	8990	85
Sandstone; white and light gray, medium to coarse-grained with pebbles of rounded quartz (cored) some interbedded hard gray silty shale (Sexton distillate sand).	9085	95
Limestone; gray-brown, coquinoïd, with interbedded calcareous in part conglomeratic sandstone and dark gray silty shale and siltstone.	9180	95
Sandstone; white and light gray medium to coarse, in part conglomeratic with rounded quartz pebbles, calcareous, mostly low porosity.	9250	70
Shale; dark gray, fossiliferous, with beds of coquinoïd limestone at top and base.	9355	105
Sandstone; white and light gray, medium to coarse-grained, conglomeratic, calcareous, with interbedded sandy gray limestone.	9450	95

# BOSSIER FORMATION

Shale; dark-gray to black, silty, with thin layers of fine, white, tight sandstone and dense dark-gray limestone.	9855	405
Sandstone; white and light gray, fine to medium-grained, calcareous, with layers of gray limestone and dark gray shale.	10,461	606
	TOTAL DEPTH	

Stratigraphic Relationships: The Shongaloo member is overlain conformably and in part gradationally by the Dorcheat member. The basal beds of the offshore facies of the Shongaloo member in most wells consists of conglomeratic sandstones that rest on the dark shales of the Bossier formation. South of T. 21 N., Louisiana, the Shongaloo-Bossier contact may be conformable, but farther north in Louisiana, it is probably unconformable. Northward in southern Arkansas, the Shongaloo rests unconformably upon the Buckner or Smackover formations.

## DORCHEAT MEMBER

Definition: The Dorcheat member of the Schuler formation is defined as including the nearshore, pastel, varicolored shales, and sandstones, and the equivalent offshore dark-gray fossiliferous shales, sandstones, and limestones lying between the base of the Hosston formation and the top of the red-green shales, sandstones (nearshore facies), and marine rocks (offshore facies) of the Shongaloo member. The type locality is the Dorcheat oil field, Columbia County, Arkansas (plate II).

Distribution: The Dorcheat member is present throughout the known area of distribution of the Cotton Valley Group in southern Arkansas and northern Louisiana. It is known to be present in the East Texas Basin, except on the northern and western flanks of the Basin, where it either merges with the Shongaloo member, or is absent by non-deposition, or by erosion, probably the latter. The Dorcheat pastel shales occur beneath the Jackson gas field in Hinds County, Mississippi, in the State of Mississippi No. 2 Fee well, Sec. 25, T. 6 N., R. 1 E., at a depth of 3215 feet. The subdivisions of the Cotton Valley in this well have not been adequately determined, although drilling continued to 5529 feet. It was probably reached by drilling in the Gulf Refining Company (E.L. Martin) No. 1 Newell Mineral Lease, Sec. 5, T. 6 N., R. 7 E., Scott County, Mississippi, at a depth of 10,310 feet. This well was abandoned at a total depth of

10,365 feet. The Union Producing Company #1 Waite, in Sec. 27, T. 8 N., R. 1 W., Clarke County, Alabama, encountered red-green shales and red and white sandstones of probable Cotton Valley age between 8870 and 11,660 feet and continued drilling to a total depth of 12,399 feet. The top of the Buckner formation was found at 11,660 feet, Smackover limestone at 11,780 feet, and Eagle Mills red shale and salt at 12,372 feet. No evidence of rocks with definite Dorcheat lithology was observed in the cuttings from this well, but part of the section probably is equivalent to the Dorcheat.

Thickness: In southern Arkansas, the Dorcheat beds thin gradually northward to the line of their truncation by pre-Gulf erosion. As there has been some pre-Hosston truncation of the Dorcheat in the northern counties of southern Arkansas, its original thicknesses cannot be determined there, but erosion probably did not remove more than 200 to 300 feet of beds. In the Stewart No. 1 Fee well in Sec. 31, T. 12 S., R. 23 W., Hempstead County, Arkansas, the Dorcheat member is only 75 feet thick, and is underlain by 245 feet of red shales and sandstones of the Shongaloo member, which rest on the Buckner formation. In the Lokey-Sheppard No. 1 Purifoy, Sec. 17, T. 11 S., R. 20 W., Nevada County, Arkansas, the Dorcheat member is only 47 feet thick and consists of pastel, varicolored shales and conglomeratic sandstones resting unconformably upon the Smackover limestone (plate IV). The Dorcheat member attains its greatest thickness of 1200 feet or more near the Arkansas-Louisiana state line and on the Monroe Uplift, in Morehouse Parish, Louisiana, thins gradually.

Lithologic Character of nearshore facies: The nearshore facies of the Dorcheat member, in its full development, consists of two principal units: the upper unit consists of interbedded shale and sandstone with shale pre-

dominating in most areas; the lower unit consists principally of sandstone with some interbedded shale (plates IV to IX). The base of the Dorcheat member is picked in most wells at the base of this lower sand section, which also marks the top of the predominantly red shales of the underlying Sexton member.

The contact between the nearshore Dorcheat beds and the overlying Hosston is sharp and well defined in most places. The upper bed of the Dorcheat consists, in some places, of pastel, varicolored shale, and in other places, of white siltstone or fine white sandstone that contrasts sharply with the coarse, partly conglomeratic sandstones and red silty shales of the Hosston.

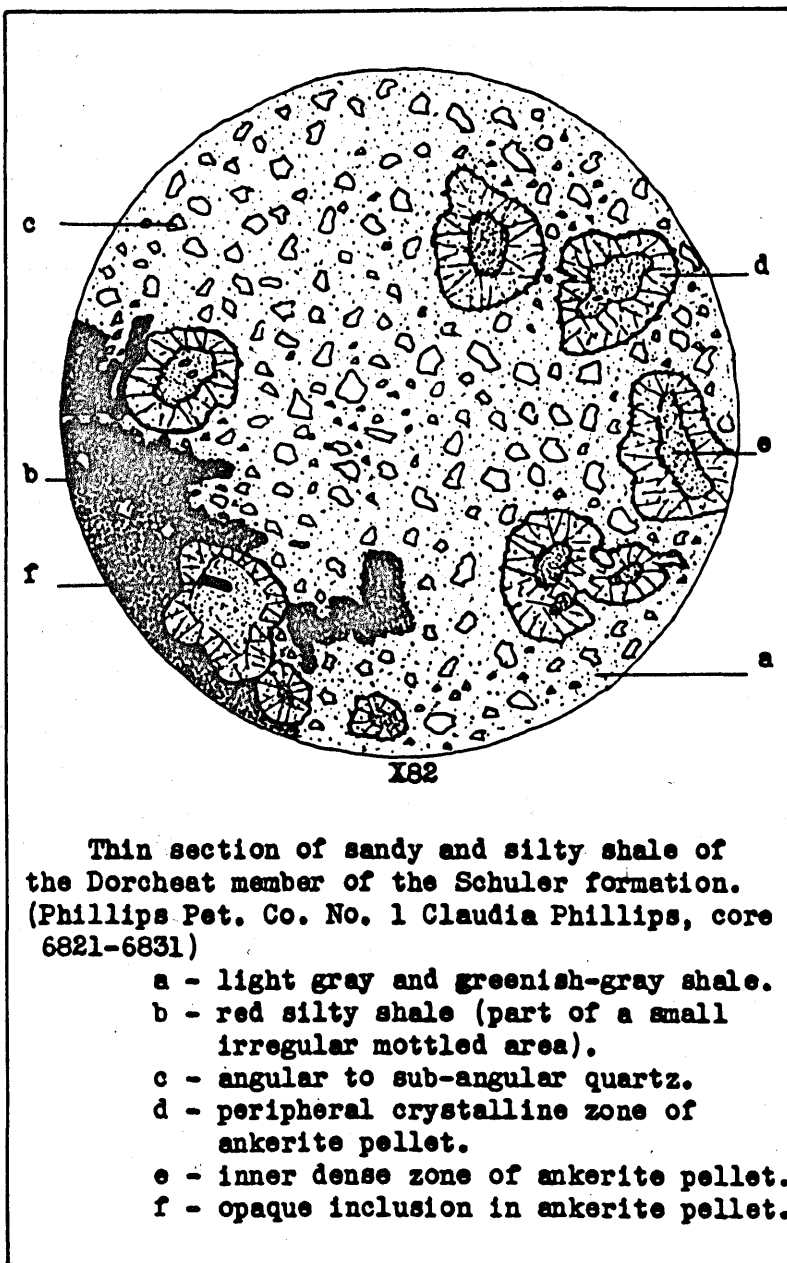
The sandstones of the Dorcheat member are mainly white or light gray, but some thin layers are red and argillaceous. The sandstones in most wells are fine-grained in the upper part of the member, but become increasingly coarser, downward. The quartz grains of most of the sandstones are angular to sub-angular in shape. Well rounded grains are rare, although the coarser grain sizes tend to be better rounded than the finer sizes. In general, the thicker sandstone bodies are less argillaceous and silty than the thinner layers. Beds of siltstone layers are argillaceous, but others consist of clean, snow-white quartz grains. Quartz and gray chert conglomerates occur in the updip parts of the member.

The most striking minor constituent of the Dorcheat sandstones, siltstones, and shales is a mineral identified as ankerite, that consists of brown spheroidal pellets averaging about one millimeter in diameter. It is generally abundant in the upper half of the member, but is not necessarily present in the highest beds. It becomes less abundant downward and

locally is entirely absent at the base. In the sandstones and siltstones it is either scattered irregularly or arranged in thin layers. In many sandstone beds the ankerite pellets have a roughened surface caused by the impression of sand grains and some pellets enclose sand grains. The pellets occur singly, in attached pairs, or in botryoidal clusters. Thin sections show that the individual pellets consist of an inner, dense, cloudy core and an outer zone of radiating crystals (figure 1). The erratic occurrence of the ankerite does not permit its use for detailed correlation from well to well.

Other easily recognizable minor constituents of the Dorcheat sandstones are volcanic ash, carbonized plant remains, dark gray chert (novaculite), and chloritic material. The volcanic ash appears as a flour-like, mostly white or gray material between quartz grains or in minute laminae. It is not common in the lower part of the member. Carbonized plant remains occur erratically in the sandstones as finely divided material. Novaculitic, dark gray chert grains occur in some sandstone layers, but their known distribution does not permit their use in detailed correlation. A green, flaky, micaceous mineral, probably chlorite, is present in the sandstones near the base of the member in many wells, but is rare above.

The shales of the Dorcheat member are typified by their variegated coloring and by their peculiar luster and fracture. The colors are mostly pale, pastel shales of gray, brown, lavender, and green, as distinguished from the darker colored red and red-green shales of the Shongaloo member below. The Dorcheat shales fracture in irregular fragments, are rather soft and clayey, and have a dull luster due to very finely divided quartz. Ankerite is the most abundant accessory mineral. For the most part, the Dorcheat shales appear to be poorly laminated. This type of lith-





ology is not at all restricted to the Schuler formation. In the subsurface of the Gulf coastal area, shales or sandstones with similar appearance may be found in the basal Upper Cretaceous, Lewisville of East Texas, southern Arkansas, and northern Louisiana, and in the Tuscaloosa of the southeastern states. The mineral ankerite is also common in these beds. The same type of shale also occurs sparingly in the Comanchean, Paluxy, and Houston formations, with or without ankerite. Ankeritic, varicolored shales, very similar to those of the Schuler, occur in the Carboniferous Pottsville and Chester beds penetrated in wells in eastern Mississippi and Alabama. Petroleum geologists in other areas will doubtless recall having seen this type of lithology in other parts of the section. The shales of the late Jurassic Morrison formation of the Rocky Mountain region are similar in appearance to those of the Schuler formation.

The Dorcheat shales are commonly splotted with red, presenting a mottled appearance. Thin layers of dark red shale occurring at rather wide-spaced intervals throughout the Dorcheat member are similar in appearance to the red Shongaloo shales below. In some wells, the red shales become more abundant toward the base of the member and the underlying upper part of the Shongaloo member has pastel varicolored shales interbedded with the dark red shales, suggesting interfingering between the two members.

Lenticularity is a striking feature of both the sandstones and shales of the nearshore facies of the Dorcheat member. Even in closely spaced field wells, it is not possible to correlate a sand or shale body for any distance laterally. This is shown excellently in a chart by W. B. Weeks and C. W. Alexander, which illustrates the nature of the sand and shale

layers of the Upper Cotton Valley beds in the Schuler Oil Field.<sup>24</sup> It seems probable that none of the individual sedimentary layers of the nearshore facies of the Dorcheat member persist very far laterally, and as a result, it has not been possible to find marker beds within the Dorcheat. The type section of the nearshore facies of the Dorcheat member is given below:

Type section - Dorcheat Member.

Atlantic Refining Co. No. 1 Pinewoods Lbr. Co., C NE NE, 16-18S-

22W, Columbia County, Arkansas, Dorcheat Field Discovery Well.

Lithology

Depth

Thickness

HOSSTON FORMATION

Sandstone; medium-grained, white and reddish, and interbedded red silty shale

6325-6402

77

COTTON VALLEY GROUP

SCHULER FORMATION

Dorcheat Member (nearshore facies)

Shale; pale gray.	6420	18
Sandstone; white, fine, silty with dark chert grains.	6442	22
Shale; pastel, varicolored, mottled red.	6473	31
Sandstone; greenish-gray, silty, argillaceous with reddish streaks, fine-grained.	6500	27
Shale; pastel, varicolored.	6515	15
Sandstone; white and pinkish, fine-grained, silty.	6525	10
Shale; pastel, varicolored.	6540	15
Sandstone; white, fine, silty.	6568	28
Shale; pastel, varicolored with streaks argillaceous fine-grained sandstone.	6620	52
Sandstone; white, fine-grained with streaks gray silty shale, oil stain.	6645	25
Shale; pastel, varicolored, ankeritic with streaks fine white silty sandstone.	6695	50
Sandstone; fine, white, porous.	6705	10
Shale; pastel, varicolored, ankeritic, with streaks of gray and white siltstone.	6850	145

24- Weeks, W. B. and C. W. Alexander; The Schuler Field Bull. A.A.P.G. Vol. 26, No. 9, Sept. 1942, pp. 1484, 85.

(cont'd) Dorcheat Member of Schuler Formation

Sandstone; white, fine-grained, silty to porous, with argillaceous streaks, oil stain.	6870	20
Shale; pastel, varicolored.	6910	40
Sandstone; white, fine, porous, oil stain.	6920	10
Shale; pastel, varicolored ankeritic.	6945	25
Sandstone; white, carbonaceous, porous, oil stain.	6955	10
Shale; pastel, varicolored, with streaks of fine white sand at top.	7035	80
Sandstone; white, silty to porous, asphaltic, interbedded with pale gray shale.	7080	45
Shale; pastel, varicolored, ankeritic.	7130	50
Sandstone; white, fine-grained, carbonaceous, with white ash, sideritic; some fragments shale in sandstone ((cored), probably as intraformational conglomerate.	7175	45
Shale; pastel, varicolored.	7190	15
Sandstone; white, fine-grained, with dark chert grains.	7218	28
Shale; pastel, varicolored.	7228	10
Sandstone; white, fine-grained.	7242	14
Shale; pastel, varicolored, with streaks of fine white sandstone; a 10 foot bed of solid red shale near top.	7320	78
Sandstone; white, fine-grained, silty.	7350	30
Shale; pastel, varicolored with streaks of fine white in part asphaltic sandstone.	7498	148
Sandstone; white, fine-grained, silty.	7510	12

Sexton Member (nearshore facies)

Shale; dark red, silty.	7545	35
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Lithologic Character of Offshore Facies: As in the nearshore

facies of the Dorcheat member, the offshore facies comprises an upper shaley unit and a lower, somewhat thicker sandy unit. The bulk of the upper unit of the member consists of dark gray, fissile, oyster-bearing shale. Interbedded with the shales, especially toward the base, are gray coquinoïd thinbedded limestones.

The lower unit of the offshore facies of the Dorcheat member is made up of mostly fine-grained, calcareous, fossiliferous sandstones, with interbedded dark, fissile shales and gray thin-bedded in part sandy, coquinoïd limestones. Minor constituents of the sandstones include dark gray novaculitic chert grains, finely divided carbonaceous material, and disseminated pyrite. The upper unit averages less than 400 feet in thickness.

and the lower exceeds 600 feet in thickness.

In most wells so far drilled in northern Louisiana, the uppermost Cotton Valley beds are those of the nearshore facies, i.e., pastel, varicolored, poorly laminated, unfossiliferous shale and fine-grained sandstone with ankerite (plates IV to VII). These beds pass downward into dark gray fossiliferous shales, limestones and sandstones of the offshore facies. The contact between the Hosston formation and the Dorcheat member in northeastern Louisiana is gradational in most places throughout a "transitional zone" several hundred feet thick. The base of the lowest coarse sandstone of Hosston lithology is considered to be the top of the Cotton Valley group, with the realization that this may not represent the same horizon, chronologically, as the contact chosen in wells updip.

In contrast with the nearshore facies of the Dorcheat, the individual layers of the offshore facies are more persistent laterally. In the North Lisbon Field of Claiborne Parish, Louisiana, for example, it is possible to correlate small units within the Dorcheat, from well to well by means of electrical logs. However, only a few units can be traced for a very great distance.

A typical section of the offshore facies of the Dorcheat member is given below:

Union Producing Co. A-1 McDonald Unit; sec. 13, T. 21 N., R. 5 W.,  
Claiborne Parish, Louisiana, North Lisbon Field.

Lithology

Depth

Thickness

HOSSTON FORMATION  
(basal beds)

Sandstone; fine-grained, white, porous.

7475-90

15

(cont'd)

<u>Lithology</u>	<u>Depth</u>	<u>Thickness</u>
<u>COTTON VALLEY GROUP</u>		
<u>SCHULER FORMATION</u>		
Dorchester Member (offshore facies)		
Shale; varicolored, ankeritic with thin layers of siltstone	7577	87
Shale; dark gray, fissile with interbedded varicolored shale and siltstone layers.	7670	93
Sandstone; very fine to fine-grained, argillaceous, fossiliferous, carbonaceous.	7700	30
Shale; dark gray, fissile, fossiliferous, with shelly limestone layers in lower one-half.	7914	214
Sandstone; fine-grained, white, porous to silty, pyritic.	7946	32
Shale; dark gray, fissile, fossiliferous, with layers of fine-grained white sandstone.	8060	114
Sandstone; fine-grained, light gray, slightly calcareous, porous.	8100	40
Shale; dark gray, fissile with thin layers of green shale.	8143	43
Sandstone; fine-grained, gray, calcareous, carbonaceous	8153	10
Shale; dark gray, fissile with thin layers green shale, slightly glauconitic, shelly.	8375	222
Shale; dark gray, fissile, fossiliferous with thin layers of fine-grained sandstone.	8550	175
Sandstone; fine-grained, gray, calcareous, fossiliferous and interbedded dark gray shale and shelly limestone.	8685	135
Shongaloo Member		
(upper part)		

Shale; dark gray fissile, with interbedded coquinoïd limestone.	9080	395
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Wesson Tongue: During the development of the Schuler oil field in Union County, Arkansas, the operators noted the existence of a thin unit of fossiliferous, dark gray, glauconitic shale near the top of the Schuler formation associated with the "Morgan" producing sands, as mentioned in a stratigraphic section of the Schuler Field by Weeks and Alexander.<sup>25</sup> Later sample

25- Weeks, W. B. and C. W. Alexander; op.cit. pp. 1477-82.

studies indicated the occurrence of this "tongue" of fossiliferous, dark gray shale in other wells in southernmost Arkansas as far north as the general latitude of central Union County (T. 18 S. of Arkansas), which is 10 to 15 miles north of the zone of principal color change of the Schuler formation. Southward, the tongue expands into the offshore facies, but its probable stratigraphic equivalent can be recognized in wells far to the south as a limestone unit lying just above the lower sandstones of the Dorcheat member.

The name Wesson is herein applied to this tongue of dark gray, glauconitic, fossiliferous shale lying near the top of the nearshore facies of the Dorcheat member. The type locality is the vicinity of Wesson in Union County, Arkansas, where two deep wells have been drilled, the Standard Oil Co. of Louisiana No. 1 Zimmerman in Sec. 29, T. 18 S., R. 16 W., and the Delta Drilling Co. No. 1 Pickering in Sec. 32, T. 18 S., R. 16 W. The type section of the Wesson tongue is given below:

Type section - Wesson tongue.

Standard Oil Co. of Louisiana No. 1 D. A. Zimmerman, SE $\frac{1}{4}$  SE $\frac{1}{4}$ , Sec. 29, T. 18 S., R. 16 W., Union County, Arkansas (wildcat, Wesson Area).

Lithology

Depth      Thickness

HOSSTON FORMATION  
(basal part)

Sandstone; white, fine to coarse-grained, conglomeratic, with pebbles of quartz and gray and white chert, partly sideritic, and interbedded red silty shale.

5425-5503      78

COTTON VALLEY GROUP

SCHULER FORMATION

Dorcheat Member (nearshore facies)  
(upper part)

Shale; pastel, varicolored, "siliceous", bearing hard, dark red, nodular hematitic material, ank-eritic, siltstone layers near base.

5593      90

(cont'd) Schuler Formation

Sandstone; white, fine-grained, silty.	5610	17
Shale; pastel, varicolored, and streaks of greenish-gray siltstone.	5670	60
Sandstone; white, fine-grained, angular, and interbedded pastel, varicolored shale.	5710	40

Wesson Tongue

Shale; dark gray, glauconitic, having irregular fracture similar to pastel shale above and below, small gastropod noted (base of Wesson Tongue)	5735	25
Shale; pastel, varicolored, ankeritic, and streaks of fine-grained white sandstone and siltstone; some of ankerite has multiple-crystalline rosette structure.	5872	137

Stratigraphic Relationships: In northern Louisiana, except in

The Monroe Uplift, the Dorcheat member is overlain with regional conformity by the Hosston formation. In the central part of the Monroe Uplift, which underwent much pre-Gulf erosion (plate VI), the Dorcheat is overlain by the late Upper Cretaceous "Gas Rock" chalk. There is probably, also, a hiatus between the Hosston and the Dorcheat in this uplift. In southern Arkansas the Hosston may be conformable on the Dorcheat as far north as T. 15 S., but farther north their contact probably is disconformable. In central Calhoun and Bradley, and in northern Ashley Counties, Arkansas, the Dorcheat is directly overlain by Gulf sediments as a result of pre-Upper Cretaceous erosion.<sup>26</sup> In northeastern Texas, scant information indicates that around the margins of the East Texas Basin, the Hosston rests unconformably on the Dorcheat. In the Stoddard et al No. 1 Smith, southeastern Ellis County, the Hosston rests on the Shongaloo member as a probable result of erosion of all the Dorcheat member (plate VIII).

In Mississippi and Alabama, the few wells so far drilled to the

<sup>26</sup>- Weeks, W. D.; op.cit. fig. 1, p. 957.

Cotton Valley show that the beds overlying the Dorcheat member consist of thick, coarse, conglomeratic sandstones of probable Cretaceous age.

In southern Arkansas and Northern Louisiana, the Dorcheat member rests conformably on the Shongaloo member, and in some areas shows color-interfingering with it. In Nevada County, Arkansas, the Dorcheat member overlaps the Shongaloo and rests directly on the Smackover limestone (plate IV). In northeastern Texas, the Dorcheat is conformable on the Shongaloo in most of the wells. However, in northwestern Bowie County, the Dorcheat overlaps the Shongaloo and rests on indurated Paleozoic sandstone (plate VIII).

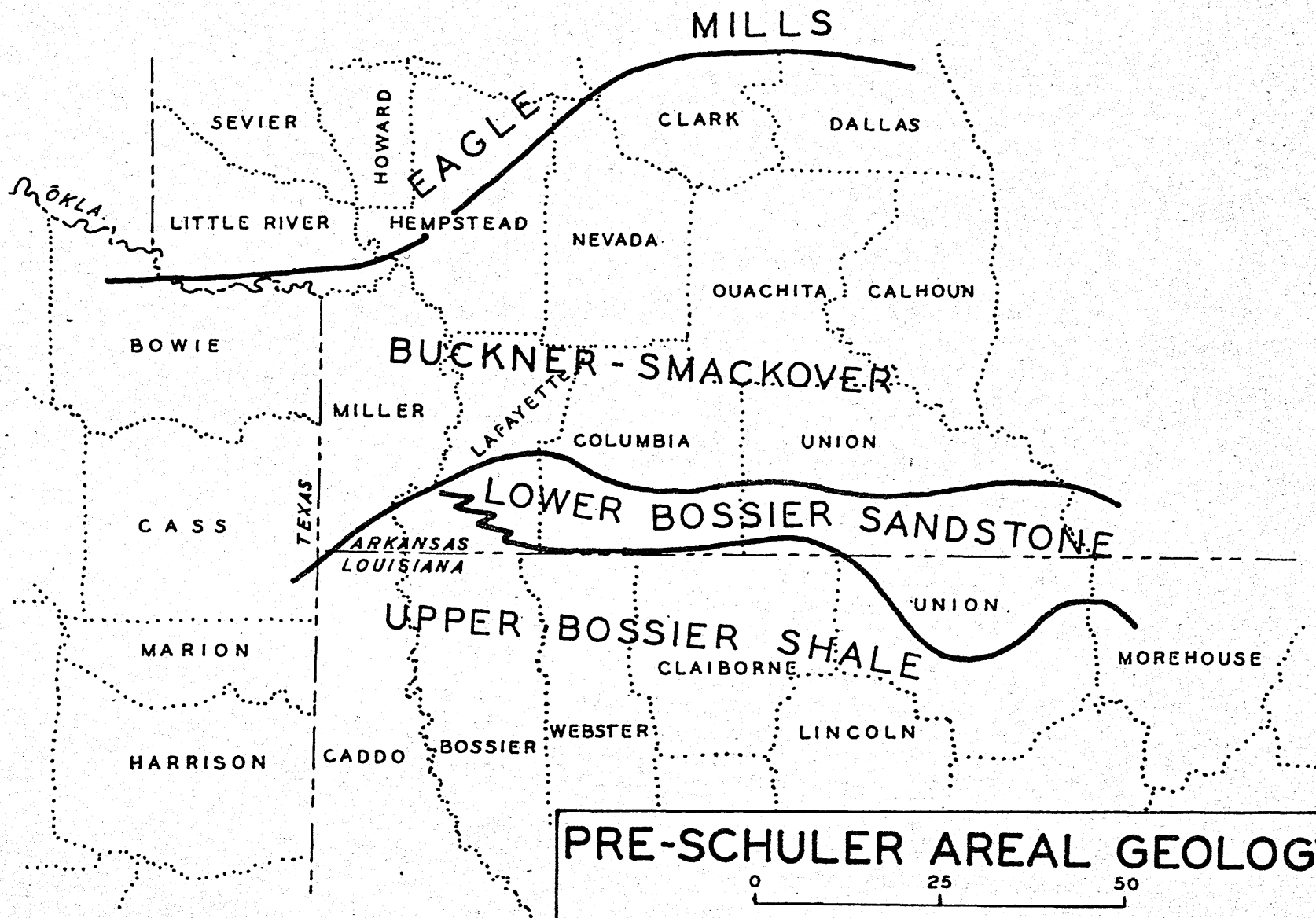


### STRATIGRAPHIC SUMMARY

The best control for a study of the deep-lying Upper Jurassic rocks of the northern Gulf Coastal Plain is in southern Arkansas and northern Louisiana, because of the large number of wells that have been drilled there. Information obtained from these wells serves as a standard for comparison with outlying areas of northeastern Texas, Mississippi, and eastward.

Reclassification herein of the entirely subsurface Cotton Valley beds as a group, rather than a formation, is believed justified as a result of the recognition within it of two subdivisions of formational rank. The lower of the two formations, the Bossier, consists in the type section, east-central Bossier Parish, Louisiana, of fossiliferous dark gray and black shale and argillaceous limestone 1635 feet thick. To the north and east, the lower Bossier becomes sandy, and in the Monroe Uplift, it passes into red beds. Present knowledge indicates that it underlies all of northern Louisiana, may underlie the east Texas Basin, but is limited to, roughly, the southernmost two tiers of townships in Arkansas. It apparently is conformable on the underlying Buckner red shale and anhydrite, but locally rests disconformably on the Smackover limestone in southern Arkansas, and in such places may also be disconformable on the Buckner. The Bossier is overlain in part with probable angular unconformity by the Schuler formation which overlaps it north of T. 18 S. of Arkansas, but south of T. 21 N. of Louisiana, the two formations may be conformable.

The ammonites Idoceras durangense Burkhardt and Glochiceras fialar (Oppel) and the pelecypod Aulacomyella have been identified by



# PRE-SCHULER AREAL GEOLOGY

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Imley<sup>27</sup> from cores near the middle of the Bossier formation at the type locality. These fossils provide a correlation with the middle Kimmeridgian of Mexico according to Imley.<sup>28</sup> The Bossier may therefore represent the Middle and Upper Kimmeridgian as the underlying "marine Buckner" formation contains the Lower Kimmeridgian ammonite Ataxioceras.<sup>29</sup>

The upper formation of the Cotton Valley Group is named the Schuler formation from the Schuler Oil Field in central Union County, Arkansas, where it is 2090 feet thick and comprises a lower subdivision of red shales and sandstones, and an upper subdivision of varicolored pastel shales and sandstones. Southward, near the Arkansas-Louisiana state line and roughly paralleling it, these nearshore rocks pass laterally into offshore dark gray shales, limestones, sandstones, and basal conglomerates. Because of their widespread persistence, the two subdivisions of the Schuler formation are named the Shongaloo member and the Dorcheat member in ascending order.

The Shongaloo member, named from the town and oil field of Shongaloo, Webster Parish, Louisiana, consists of an upper unit of shale, sandstone, and limestone, and a lower unit of conglomerate, sandstone, shale and limestone, occurring in two facies distinguished by color. The nearshore facies is made up of red and green shale of darker color than that of the overlying Dorcheat member, red and white sandstone and conglomerate. This facies is restricted mainly to southern Arkansas and the Monroe Uplift in northeastern Louisiana. The offshore facies comprises dark gray fossiliferous shale, sandstone, limestone, and basal conglomerate, and is restricted mainly to north-central and northwestern Louisiana and the East Texas Basin.

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27- Imley, R. W.; written communication.

28- Ibid.

29- Ibid.

The Shongaloo member attains a thickness in excess of 1000 feet in T. 18 S. of

Arkansas and thins both shoreward and basinward from this latitude.

North of township 17 south, Arkansas, this member overlaps the underlying Bossier formation and rests upon the Buckner or Smackover formations. As far south as T. 21 N. of Louisiana, the Shongaloo rests with probable angular unconformity on the Bossier, but to the south their contact may be conformable. The Shongaloo member is overlain conformably by the Dorcheat member except in updip areas of southern Arkansas and northeastern Texas where the Dorcheat overlaps it locally.

The Dorcheat member, named from the Dorcheat oil field, Columbia County, Arkansas, consists of an upper shale and sandstone unit and a lower sandstone unit. There are two facies of the member, which are distinguished by color. The nearshore facies comprises pastel varicolored shales, and white sandstones in which small pellets of brown ankerite are abundant. The offshore facies comprises dark gray fossiliferous shale, sandstone and shelly limestone. The Dorcheat member attains a thickness in excess of 1200 feet near the Arkansas-Louisiana state line and thins both shoreward and basinward from this area. The Dorcheat is overlain unconformably by the lower Comanchean Houston formation north of T. 16 S. of Arkansas and around the northern and western margins of the East Texas Basin, but southward their contact is probably conformable. The Dorcheat is conformable on the Shongaloo member, but overlaps it locally in updip areas.

Paleontological evidence of the age of the Schuler formation is meager, but pelecypods obtained from cores in the Schuler are of Jurassic age according to Imley.<sup>30</sup> The Schuler may be Portlandian and Tithonian in age, as it rests unconformably on the Middle and Upper (?) Kimmeridgian.

<sup>30</sup>- Imley, R. W.; personal communication.

Table II . Time relations of Upper Jurassic formations in southern Arkansas and northern Louisiana  
(prepared in collaboration with R. W. Imlay)

European Stages		Southern Arkansas	Northern Louisiana
Tithonian		<div>Hiatus</div> <div>SCHULER FORMATION</div>	
Portlandian		<div>nearshore "red beds"</div> <div>basal conglomerate</div>	offshore fossiliferous beds
Kimmeridgian	Bononian	<div>Hiatus</div> <div>BOSSIER FORMATION</div>	
	Havrian	<div> <u>Idoceras</u> cf. <u>I. durangense</u>  <u>Glochiceras</u> cf. <u>G. fialar</u>  <u>Aulacomyella</u> sp. </div>	
	Sequanian	<div>BUCKNER FORMATION</div> <div>anhydrite and red beds</div> <div><u>Ataxioceras</u></div>	
Oxfordian	Argovian	<div>SMACKOVER LIMESTONE FORMATION</div> <div> <u>Dichotomosphinctes</u>  <u>Discosphinctes</u> </div>	
	Divesian	<div>EAGLE MILLS FORMATION</div> <div>red beds</div>	<div>Norphlet tongue</div> <div>massive salt</div> <div>Louann tongue</div>
Callovian		Hiatus	

Bossier formation.<sup>31</sup> Table II illustrates the time relations of the Upper Jurassic rocks of southern Arkansas and northern Louisiana.

A discussion of the sedimentary and structural history of the Cotton Valley Group must await a separate study of the adjacent rocks. However, it is appropriate to make a few observations relating to this subject. (1) The Sabine uplift was a positive area as early as Middle Kimmeridgian time, because both the Bossier and Schuler formation are relatively thinner there than in surrounding areas. (2) The Monroe Platform was not an important positive feature during late Jurassic time, as great thicknesses of nearshore sediments accumulated there. (3) The offshore parts of the Bossier formation probably were deposited in relatively deep water resulting in the formation of almost-black ammonite-bearing shale. (4) The offshore parts of the Schuler formation were deposited in relatively shallow water, abundantly inhabited by oysters. (5) The nearshore Shongaloo sediments probably were derived from a backland having steep relief, resulting in the formation of conglomerates and were deposited in an environment which prevented widespread reduction of the red coloring in the clays. (6) The nearshore Dorcheat sediments probably were derived from an area of less steep relief and underwent more complete reduction of the originally red color than the Shongaloo sediments. (7) These observations, supported by evidence of local transgression of the Shongaloo by the Dorcheat, suggest that an almost complete cycle of erosion is represented by Schuler time. (8) In East Texas, the belt of nearshore rocks of the Schuler formation is much narrower and this formation is relatively thinner than in southern Arkansas. (9) In western

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31- Imley, R. W.; personal communication.

Table III. Distribution of producing sands of Cotton Valley Group

Stratigraphic Divisions of Cotton Valley Group				Fields Producing from Cotton Valley Sands										
				Schuler	Dorcheat-Macedonia	New London	Mount Holly	Nick Springs	McKemie	Atlanta	Cotton Valley	Shongaloo	North Lisbon	Beekman
COTTON VALLEY GROUP	Formation	Dorcheat member	Upper shale and sandstone unit	some "Morgan" sands						"A" sand				
			Lower sandstone unit	most "Morgan" sands	some producing sands		"Lewis" sand	producing sand	"Cornelius" sand		"B", "C", "D", "Bodcaw", and "Davis" sands	"Duke", "Simmons", "Vaughn" sands	"Beekman" sand	
		Shongaloo member	Upper shale and sandstone unit	producing sands	"B-1" sand					"Young" sand	"Roseberry" sand			
			Lower conglomeratic sandstone unit	"Leona" sand	some producing sands	producing sands					"Sexton" sand	"McDonald" sand		producing sand
	Bossier Formation			"Jones" sand										
	Smackover Limestone Formation (upper oolitic unit)			production	production	<u>show oil</u> water	production	water	production	production	not tested	not tested	production	<u>show oil</u> dry

Alabama, the standard subdivisions of the Cotton Valley group are not well defined due to differences in source and mode of deposition, but both formations probably are represented there.

Sandstones in the Cotton Valley Group have produced large amounts of petroleum and new deposits are being found each year. The Cotton Valley producing sands are listed by fields in table III.